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USSR Report

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

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USSR REPORT

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

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COMPUTERIZATION IN CEMA COUNTRIES DISCUSSED

Moscow SOVETSKAYA KULTURA in Russian 14 Jan 86 p 8

[Interview of Minister Plenipotentiary, trade representative of the People's Republic of Bulgaria to the USSR Georgi Dzhambov by V. Svirin]

[Text] The trademark "Made in Bulgaria" has become as well known in the Soviet Union as the trademark "Made in the USSR" has become well known in Bulgaria. But there are products on which both these inscriptions are placed alongside each other.

"And it is not surprising," says G. Dzhambov, "after all, there are broad contacts between the national organizations of science and technology, academies, departments, organizations and institutes of our countries. Common design collectives and joint research groups have been created and direct contacts between enterprises have been established. Further strengthening of these contacts is envisioned in the recently adopted Integrated Program for scientific and technical progress of CEMA countries up to 2000.

[Question] Five priority directions have been named in the Integrated Program, and the first of them is electronization of the national economy. What kind of joint experience exists here.

[Answer] There is apparently no computer center in the USSR in which Bulgarian units are not used. We deliver to the Soviet Union memory units, word processors, microprocessor systems for automatic control of different facilities. Approximately 80 percent of our needs for components and assemblies for products of the electronics industry are imported from the USSR.

Bulgarian and Soviet designers are now developing jointly the new YeS-1037 computer and subsystem, which will provide a high data processing speed, high write density and considerable memory capacity. Agreement has been reached on joint work in organizing the output of a quasi-electronic ATS [automatic telephone exchange] of the Kvant type, controlled by a computer, in Bulgaria. Radio relay equipment, including that for transmission of television programs, is being designed jointly.

You recall that SOVETSKAYA KULTURA in a reportage from the Bulgarian National Exhibit at Moscow wrote about the electronic "stenographer"--a unique device

that permits one not only to transfer oral speech to paper, but also displays the text that has already been printed. We have now delivered 20 of these devices to the USSR.

[Question] There is yet another priority direction, defined by the Integrated Program--accelerated development of nuclear power engineering.

[Answer] The Soviet Union is fulfilling the functions of the general designer of an AES [nuclear power plant] and general equipment designer within CEMA. We are constructing the largest nuclear power plant Kozloduy with the participation of the USSR and another--Belene--is under construction. I would like to note that many Soviet enterprises and specialists are participating in establishment of nuclear power engineering and nuclear energy machine building in Bulgaria.

[Question] And at the same time Bulgarian specialists are working in the USSR. For example, there are the timber procurement agents in the Komi ASSR.

[Answer] There are not only timber procurement agents. Bulgarian builders have given a good account of themselves on the Soyuz major gas pipeline, in construction of a number of mining and concentration combines in Western Siberia and Uzbekistan, in the Ukraine and in the Northern Caucasus and in the Nebit-Dag and Yaroslavl. There is a directorate "Construction of the People's Republic of Bulgaria in the USSR," on the account of which are more than 200 cultural-service facilities, 1,800 square meters of housing and so on. And as compensation we receive an additioanl quantity of cellulose, oil, gas and iron-containing raw material.

[Question] It is also mentioned in the Integrated Program for scientific and technical progress about widescale automation of the national economy. What contribution is cooperation of our two countries making to it.

[Answer] Here is just one feature. Bulgaria has already delivered to the USSR many robots, manipulators, electric and automatic loaders and machine-tool control systems. They include two-thirds of all industrial production of Bulgaria, which is produced at plants, factories, wherever equipment, technology and special materials have been delivered from the USSR. There are more than 330 large industrial facilities that determine the modern industrial potential of the People's Republic of Bulgaria and which have been designed, constructed and developed with the fraternal assistance of the Soviet Union.

[Question] What can be said about cooperation in production of national consumer goods.

[Answer] Some products of the footwear and leather-haberdashery industry are being produced jointly. The technology for manufacture of bone china was developed and introduced jointly at one of our plants and the People's Republic of Bulgaria has now become one of the few countries where this elegant product is being born. And there is more: 23 Bulgarian enterprises exchange knowledge and experience for improving the quality and expanding the variety of national consumer goods in partnership with the USSR. And take light machines. We annually ship 650,000 sets of electrical equipment and storage batteries for VAZ [Volga Automotive Plant imeni 50-Letiya SSSR] and we assemble Moskvich automobiles from assemblies and parts shipped to us.

[Question] What Soviet goods are popular on the Bulgarian market.

[Answer] Lada automobiles, movie cameras and photo cameras, watches, radios and tape recorders, television sets, refrigerators and various types of home appliances. We almost never satisfy the demand for most of them on the internal market. I will not ask you which Bulgarian goods are popular in the USSR--I know since I am involved in commerce. If you don't take electronics and machine-building into account, then the primary product is pharmaceutical chemicals: shampoos, lotions, perfumes and cosmetics, toilet water and medicinals. These are products where extracts of the well-known rose are used. I will add to this furniture, sewing products, footwear, candelabra and ceramic dishes.

And in conclusion I would like to say the following: the strong unity and true friendship with the fraternal Soviet people were always a strategic line of the Bulgarian Communist Party. And this is now one of the decisive factors for successful construction of developed socialist society in our country. I repeat the popular expressions of Bulgaria: common ideas, common goals, a common struggle and our common communist future link us to the USSR.

6521
CSO: 1863/183

INTRODUCTION OF HOME COMPUTERS IN SOVIET UNION

Moscow LENINSKOYE ZNAMIYA in Russian 25 Dec 85 p 3

[Article by Yu. Kogtev: "Where's the End of the Line to Purchase a Computer?"]

[Text] This question could recently be heard in the Moscow consumer store Elektronika on Leninskiy Prospekt. A model of an essentially new device, developed by suburban Moscow and Moscow designers--the BK 0010 personal microcomputer--was displayed here on a demonstration bench. This is the country's first and still only model of a home computer.

What should we ask it?

A leading software specialist of the Eksiton Plant A. S. Khamitov waited until I became familiar with the instructions. Selecting the options of the home computer enumerated in it is rather extensive. Solution of computer tasks. Intellectual gains. Teaching programs. Control of domestic appliances. Creation of a personal data bank. Which should one choose?

"Let us begin with a game," suggested Aleksandr Saydulovich. "Even more so, since our computer manages the 'family tree' of the television accessory for electronic games which industry produced several years ago. Although compared to that accessory, our BK has gone far ahead."

The screen of a color television set to which the computer is connected displayed the words: "Ready for work." The programmer typed the name of the game--Mars--on the keyboard, containing about 100 different colored keys. He entered the program into the memory of the machine with an ordinary portable tape recorder. And now on the electronic "sky" appeared Martian flying saucers. Take over the control button quickly! I was prepared to repel the attack of the crafty aliens. The electronic "battle" broke out.

"Not bad for beginning," Khamitov evaluated the results of the campaign. "And now let us continue our games. Perhaps we can check your knowledge of the Russian language?"

And again a game, but one that requires not so much speed of reaction as a knowledge of the Russian language in the fifth form of the secondary school. Can you correctly place the accents in the words "optovyy" (wholesale), "zarzhavet'" (to become rusty), "kremen'" (flint) and "zvonit" (rings)? If

you cannot always do so, the machine corrects you. And it immediately gives a total grade of success.

The next task is a game with bricks. True, electronic bricks. We build on the screen a fantastic varicolored building according to formulas assigned by the computer. These exercises develop creative fantasy in children. But how to arrange in the most optimum manner garden plots, currant bushes and fruit trees on a small section? Practical sharpness is required of the programmer.

"Of course, everything that we have shown you is only a small part of the capabilities of the microcomputer," as Aleksandr Saydulovich concluded our games. "Future programmers begin to communicate with the computer for entertainment. But in the future communication will replace serious entertainment with problems of computer mathematics. The computer will become an indispensable assistant to economic managers, scientific workers and engineering and technical personnel and economists. It is no accident that our BK, which has been delivered in small lots to the commercial network of Moscow and Leningrad, sold out within the first hours the stores were open. The demand is high. There are no similar machines, since its closest 'relative' is among the family of personal computers--the Agat--which considerably exceeds the BK in complexity and of course cost."

In time the television accessory for electronic games declined in sales and soon disappeared from the shelves. This circumstance did not make its authors too unhappy. The accessory was only a step along the path toward implementation of the main goal, posed by the designers of Pavlovskiy Posad--design and development of the first Soviet home computer.

The experience of using the main "bricks" of modern computers--large integrated circuits, or BIS, each of which replaces hundreds of thousands of transistors--is already available among the enterprises. A series of telephone devices with button control and main memory, equipped with LSI, was the first, although a very remote approximation of the computer. But the technical difficulties the developers had to overcome!

But they did!

In 1982, five experimental models were manufactured. They were not very imposing at first (the cabinet was made of metal due to a lack of a base for stamping plastic). Not everything was perfected (not a single program had been developed). But the words "Ready for work" appeared on the screen. There was something with which to begin. The computer startled the imagination with the phenomenal speed of calculation--300,000 arithmetic-logic operations per second. Silver and bronze medals of VDNKh [USSR Exhibition of Achievements of the National Economy] won the necessary support and confirmation of the correctness of the selected path.

An enthusiastic young collective was established around the computer. It was headed by a graduate of MIEM [Moscow Institute of Electronic Machine Building], specialist in electronic instruments S. M. Kosenkov, now the chief of the

Department of Microcomputers and Household Appliances. A. I. Polosin participated in development of the LSI. The general "idealogue" of the project was Z. A. Schepitskiy. Yu. N. Vrublevskiy managed the preparation for production. The director of the enterprise G. P. Morozov supported this development.

The plant is now at the beginning of mass production of BK computers. If, previously, the plan for production of the computer was corrected downward--who knows whether they will be purchased or not?--beginning this year, the plan was corrected toward a sharp increase. The computers are being awaited at scientific laboratories, shops and school offices of infomatics. They have changed from the rank of intelligent games to the rank of instruments required in the home, that determine the further development of scientific and technical progress.

One can gain the impression from all the foregoing that the history of development of computers has been completed successfully. In fact, the designers understand that it is still too early to become complacent.

True, the collective has gained confidence in the importance of the postulated task. True, work is proceeding with an attitude about which any design office can dream. But they are not without concern at the present as to whether the difficulties will be surmountable in the future.

If you dear reader are seized suddenly with a desire to purchase a computer immediately, take the following into account. Of course, when you bring the carton with the inscription "Home computer" into the home, your prestige in the family will rise to an unprecedented height. But in the next moment it may descend to confusion. And namely at the stage of connecting the BK to the television set. There are only a few types of television receivers that have the jack required for this connection.

This is the first complication. It can be corrected either through use of a repairman who knows how to modify the jack or by using a special accessory--a modulator, manufacture of which will begin next year.

There is also a second serious obstacle. A product whose value is determined not only by the electronic "stuffing," but also by "idealogical" support, first appeared on the domestic market. That is, the availability of programs. The set for the time being contains only one cassette: an electronic game, a teaching program, solution of a system of equations and an advertising roller. This is an extremely small amount. Hundreds and thousands of programs--a real bank of ideas--are necessary for scientific and technical purposes! And many of them have already been developed. There are approximately 100,000 programs throughout the world and a large part of them have been written in "BASIC" language--a special language in which programs are compiled. But our computer understands only a different version--"Fokal." Where is the way out?

Kosenkov demonstrates a small removable unit to translate BK to "BASIC." This unit will also be produced next year. But it will not be able to solve all problems.

"We are now finding a temporary way out of the situation," Sergey Mikhaylovich admits. "We agreed to make the BK available to scientific organizations, but on one condition. We request that they develop several programs for us. These agreements have been concluded with scientists of Riga and Udmurt universities, the Minsk Radio Engineering Institute and other organizations. Of course, when the computer becomes universal, this method will hardly satisfy us. A programming service is required and we feel that the users rather than the producers must develop it--that is, the scientific organizations and enterprises."

Regardless of how intensive matters stand with software, Kosenkov decided to compile one program through his own efforts. Imagine the following picture: Krokodil Gena shows you on the screen a letter of the alphabet and asks you to name it. If you do not answer within 2 seconds, he places it into his toothy mouth with pleasure. According to the author's idea, this program will help young children to learn letters more rapidly if of course they do not wish the voracious Krodil (crocodile) to eat the entire alphabet from "A" to "Ya."

The program "Krokodil Gena" is designed for kindergarten. Study rooms of informatics and computer mathematics, about which our newspaper write recently, have already been opened in several schools of Pavlovskiy Posad. Why not go even further and begin to teach programming in kindergarten?

This year three schools of Pavlovskiy Posad and one training production combine will receive study rooms of informatics and computer technology, equipped with BK computers. These classrooms will subsequently be opened at Elektrogorsk and also in some of the rural schools. A programmer room will soon appear in the plant dormitory--the "home of the young specialist."

As we can see, the computer is entering our lives more actively. The "intrusion" is being developed most actively where the hardware is produced. Within a year the accounts for domestic microcomputers will surpass tens of thousands. Within 5 years they will become customary household appliances.

Computers are rushing to us. They should become our friends and helpers. Are we ready for this encounter?

6521
CSO: 1863/184

PROMISE OF PERSONAL COMPUTER USE AT HOME NOTED

Moscow NEDELYA in Russian No 9, 27 Feb 86 p 10

[Article by M. Razmakhnin, candidate of technical sciences and P. Stepanov, programming engineer, "What Can a Home Computer Do? It is a Teacher and a Messenger and a Household Manager . . ."]

[Text] Quite a lot! Look at the diagram shown below [not reproduced]. Just as any computer, a home computer can be used for computations and calculations. But this is not the most important thing for it. Such a computer comes to play the part of a household organizer, handling the leisure and work of all of the family members; it stores and prints out all of the necessary data at the first request; it teaches and entertains, and assists its owner in the development of creative capabilities, responses and memory.

It is very difficult to enumerate all of the possible variants of home computer use in each particular family. Suffice it to say that the leading companies manufacturing personal computers have developed and produced for the market several thousands of programs oriented towards typical applications. When purchasing a personal computer, the user acquires the applied program package that he needs. However, if the requisite program is not on the market, this is not a calamity. The user is quite capable himself of writing such a program with a home computer.

"How is that?" marvels the reader. "I don't even know how to program." Learn how: one of the standard programs makes it possible for the home computer to teach its owner to be a quite tolerable programmer. And moreover, it also teaches knitting, geography, biology, touch typing, the skills of driving a car on a slippery road and much else. But the main thing is that the home computer opens up to us the road into the world of computer technology. If you like, a home computer is a unique kind of "computer campaign against illiteracy", the first step towards the literary competence of the 20th century. It is difficult to overestimate the social importance of such a process in our time, when the skills of working with computers must be mastered by designers and process engineers, bookkeepers and white collar workers in savings banks, librarians and transportation workers, physicians and workers in other, extremely diverse professions.

Specialists note that many of those who have acquired an inexpensive home computer soon return to the stores to buy even more sophisticated and powerful

professional personal computers although they are considerably more expensive. As they say, they have acquired a taste for them. And it is understandable why: for computers save us effort and time.

For example, there are word processing programs (they are frequently called text editors). Everyone who has to write a lot, and not only writers and journalists fall in this category, but also scientific workers, physicians, translators, composers (yes! you can write music with a computer no less conveniently than you can write articles about computers; admittedly though a specialized text editor is required for this) easily understand why they are so popular. A good modern word processor permits the following: the selection of a text, correction of errors, the substitution of one word for another, the changing of the format of a page, the storage of all intermediate and final variants of your work on a magnetic disk, the incorporation of drawings in the text, the checking and correcting of orthographic errors as well as much else.

Programs called "data bases" are good for those who like to have a well organized archive in which you can store a listing of the books from your library, a bibliography for a dissertation and any aphorisms. And not only can any information be easily stored, but it can be quickly found.

There is yet another quite promising job for the home computer: a "messenger". A computer is connected to a telephone with a small device called a modem. Now, in a few minutes, you can send your article to any address (naturally, there must also be a modem and a computer there for this).

Many centuries ago, the book came into the everyday life of man. Later came the radio and the telephone. Now the time has come for the computer. Just like its predecessors, it will become a daily tool for human interaction.

The "Home Computer" Knows How To Do All of This

--Games: logical and combinatorial, developing memory and response, and for diversion;

--Creativity: music composition, melody playback, graphics, animated cartoons;

--Control: electric household appliances, radio, television, tape recorder, timer, alarm clock, residential security system;

--Data storage: lists, card file, diary, archive, statistics;

--Teaching, skill improvement: programming, computer technology, foreign languages, physics, mathematics, etc.;

--Information: reference service (domestic services, schedules, weather, etc.), recording telephone conversations, automatic answering service, data output from storage to display;

--Accounting and control: budget, leisure, statistics, scheduling of business meetings and work, consumption of electric power, gas, heat and water supply;

--Data processing: calculations, search ordering, statistics.

In the photograph: the "BK 00-10" [not reproduced].

8225
CSO: 1863/188

SHORT SUPPLY AND SPECULATION IN PERSONAL COMPUTER COMPONENTS

Moscow NEDELYA in Russian No 9, 27 Feb 86 p 11

[Article by A. Osokin, "We Take a Look: Homebrew Computers Have Appeared! How Much Does a Memory Cost Now?"]

[Text] Demand creates supply. This economic law, naturally, has also been reflected in the computer problem. The demand for computers, as we have seen, is great. Supply . . . We know that this formula has yet another aspect in this same problem. The shortfall of personal computers, on one hand, and the striving towards personal technical creativity on the other has generated, much as in the case of amateur radio, also amateur computer operation. Yes, many of our fellow citizens are building homebrew computers at home. Be that as it may, there is, on the other hand, first this story of our correspondent.

Six o'clock in the evening. The "Pioneer" store. Fifteen degrees below zero. There is a crowd of people at the store window. They walk from one side to the other with a vacant look, as if they are waiting for someone - but not you. But it is worth it to hold back the pace as one little smile immediately breaks out beside you, then another and several voices affectionately whisper in your ear, "What do you need? What can we get you? What are we interested in?"

Nothing as yet. I go into the store. After a couple of minutes I come away from the sales counter empty-handed. And I am again in the circle of "well-wishers". I explain to them: I don't know my way around very well in the technology, but friends have asked me to keep an eye out for parts and circuits for computers capable of making music. But admittedly, I didn't believe very much that I would succeed.

"Well . . . this will cost you a fair piece of change," drawled a shaggy-headed snub-nosed fellow, "Maybe you would like a microcircuit for three rubles?"

"Young man," a portly old man gave me an exaggerated wink, "let's go have a quiet little talk. It seems I am able to help you out . . ."

"He's a phony," a big, fat-faced man looked me dead in the eye, "I see through it . . . Garbage!"

The circle of my "friends" in the "Pioner" store quickly melted away. But not for long.

A tall thin young man, looking around in all directions and presenting a significant appearance, asked, "You need a memory?"

The issue obviously involved a computer memory. I had not complained about my own memory . . . Let us assume that I would have needed this memory. But the price - 50 rubles! And if we haggled over the price, then 150 rubles!

Yet another man came up to me, having the manner of a provincial actor, in a sheepskin coat. He said in a lordly voice, "Well there my boy, if you can't make it yourself, drag on over here and we'll cobble together what you need . . . "

And with that we broke up.

As you see, the demand here exceeds supply. And as always, this becomes the object of speculation. It is obvious that the demand will grow. And with it also the gap between desires and capabilities. Apparently, this deserves the attention of our industry and even now they should be thinking about producing parts and components for personal computers, so as not to extend the list of things called scarce.

8225
CSO: 1863/188

SHORT SUPPLY AND LARGE DEMAND FOR PERSONAL COMPUTERS IN MOSCOW

Moscow NEDELYA in Russian No 9, 27 Feb 86 p 11

[Article by Ye. Dikun, "View from the Store; Why is 'Zero-Zero-Ten' So Slow in Getting to Us?"]

[Text] At daybreak a long "tail" had formed at the Moscow store "Elektronika" on Leninskiy prospekt; it had been rumored the day before that personal computers would be for sale. The rumor was right. That day, tens of persons became the first happy owners of the Soviet made BK 0010 personal computer. This was in May of last year. . . today there is no crowd forming around the store. There are also no computers.

"In 1985, we sold a trial, quite small batch of computers, 194 units in all," states the "Elektronika" store manager, Vladimir Andreyevich Gusev. "They were sold out in a few days. They would have all gone in just as many minutes if the sale of one computer did not take exactly an hour ."

"Why so long?"

"It must be connected to a TV set and a cassette player to be checked and to show the buyers what the machine knows how to do and how to operate it."

"Were there any complaints from the buyers about the quality of the product?"

"No, there was not a single claim for replacement."

"How many computers do you think your store could sell?"

"No less than 200 a month. And this is only the beginning. . ."

"That is, more than 2,000 per year?"

"Some tens of thousands of computers are needed in order to saturate the Moscow market. The nation needs millions though."

"Do you frequently deal with the question: when will there be computers for sale?"

"We do, from about 10 people a day."

"Who are they?"

"Quite different people: engineers, physicists, journalists, physicians, students and there are even musicians."

"Well then, when will computers again come in for sale?"

"Alas, I do not know."

We turned with this question to the "Elektronika" Central Commercial Advertising Association. The chief of the association, Anatoliy Georgiyevich Semenkov, replies:

"I cannot name a precise date, but I can tell the readers of NEDELYA that computers should be in the 'Elektronika' store in March. About 4,000 BK 0010 will arrive there this year. I would like it to be more, but now the schools must first be provided with computers."

"How much will this computer cost?"

"In the 600 ruble range."

"How do you plan to further expand trade?"

"We are planning to open a company store for the sale of videotape recorders and computers next year on Leningradskiy prospekt. The Ministry of the Electronics Industry is planning to organize cost-free two-week courses there for those who want to learn how to work with computers."

"And if there are again predawn vigils around the store, if someone tries to warm his hands by selling scarce computers? Perhaps the electronic enthusiasts will show in their own company store how the trade must be organized? They have set up a preliminary list, and they themselves will monitor the movement of the line. The addresses of their own buyers are entered in the computer and they report to them when to go to the store for the computer. You are dealing here with advanced technology and this means that its sale must also be organized at the same level. Right, Anatoliy Georgiyevich?"

"I agree with you. We accept the proposal of NEDELYA for the notice. We will proceed with this. If, of course, demand will exceed supply."

8225
CSO: 1863/188

SOME COMPUTER INFORMATION AND DEFINITIONS

Moscow NEDELYA in Russian No 9, 27 Feb 86 p 11

[Article, "We Provide Information"]

[Text] Although the word "kompyuter" literally means "computer" and "computer device" as translated from English, and is used in Russian as a synonym for EVM [electronic computer], there is a certain difference between these two terms. The fact is that, as a rule, the word "kompyuter" is used today in those cases when one desires to underscore the fact that the issue involves a device intended not only and not so much for calculations as for information processing in general.

Each computer consists of a processor, information input/output peripherals and a peripheral memory for storing data files and programs. A large or central computer takes the form of rows of racks with disks and tape hardware, which occupy an area of more than 100 square meters. The cost of such computers is millions of rubles.

Minicomputers have a peripheral memory along with the other units that is all housed in one to two racks, which occupy an area of 20 to 60 square meters.

A microcomputer is a compact, desk-top unit consisting of two to three modules. One module combines the processor, memory and display, while the other has a keyboard. The peripheral memory is sometimes allocated to a separate module. Various hardware can be connected to the processor module: miniature printers, plotters, communications line interfaces, additional memories, etc. It is specifically these machines that are usually called professional personal computers.

A home computer is a simplified computer and is a variant that is approximately 10 percent as expensive as a personal computer.

8225
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COMPUTER FOR YOUR APARTMENT

Moscow IZVESTIYA in Russian 24 Mar 86 p 1

[Article by A. Golubtsov. Text enclosed in slash marks is printed in italics in original source.]

[Text] The title is not an exaggeration; no new model of a calculator is being discussed, but rather a real personal computer created by specialists at the Ministry of the Electronics Industry. Our special correspondent A. Golubtsov discusses the Elektronika BK-0010, which is the name of the "home" computer.

D. Polivanov, chief technologist at the Main Scientific-Engineering Administration of the Ministry of the Electronics Industry, who is one of the creators of the new computer, talks about its capabilities.

"It is as if this device unites the capabilities of a tape recorder, portable television, and computer. The amount of operations makes it possible to use the computer to accomplish the most diverse tasks. The Elektronika may be a reference book or a dictionary, it can tell a person how to prepare one dish or another, and it may assigned the task of controlling an air conditioner in order to maintain the temperature and humidity conditions you have selected in your apartment. The Elektronika is a fine partner for a chess battle. And it can do all these things at the same time, without leaving any of them for later.

A program is entered into a home computer using a digital language whose code may be learned from the appended instruction. It is not complicated to assimilate. In any event, school children have successfully mastered the skills of programming. Moreover, the correctness of the formulated task may be checked on the screen of the display unit, and the computer itself helps avoid certain mistakes.

/The new computer promises to be of great use in school. The Elektronika BK-0010 Sh (school model) is one of the links in preparing school children to work with computer technology. The simplicity of controlling the machine makes it easier to assimilate the fundamentals of programming. However, the Elektronika with the index "Sh" is not simply a computer, but also an excellent electronic visual aid. For example, with its help a teacher can easily present any chemical experiment without reagents./"

12794
CSO 1863/266

DEVELOPMENT OF SPEECH-SYNTHESIZING COMPUTERS IN USSR

Moscow TRUD in Russian 17 Jan 85 p 4

[Article by N. Dombkovskiy: "The Speaking Chip"]

[Text] When Karel Čapek thought up the word "robot," visionaries of all countries began to compete in describing the "mechanical man." They gave it a mass of supernatural qualities, of course, including the capability of speaking. But even the most daring imparted a metallic tone, devoid of intonations, to this speech. As it turns out, the visionaries were wrong. Through the efforts of Moscow scientists, automatons now speak in the most natural voices, indistinguishable from our voices.

Each of us processes a mass of informaiton daily. And whereas visual information--in the form of printed text or indications of instruments--is processed automatically, matters are much more complicated with acoustic information. And how nice it would be if equipment would take on itself the labor of reporting online information by voice to us. Let us say, to warn about an emergency situation in production or in transport, to make announcements about the arrival of trains and aircraft and finally to issue a list. How many people could be freed of fatiguing monotonous work!

But to force a machine to speak, one must first recognize the laws of speech formation. This is a difficult matter. Specialists have been struggling with this problem for many years and are still far from complete success. Although there are some achievements: instruments have been created at some scientific research institutes which, doing away with text, attempt to synthesize human speech. The voice comes out "dead," with a metallic tone. The colleagues of the Scientific Research Institute of Radio, USSR Ministry of Communications, have traveled a different path.

A small box in the end of a small portable transistor-size receiver clearly displays red numbers--the exact time. The manager of the subdivision of the scientific research institute Aleksandr Kushtuyev handed me the telephone, connected to the instrument: "Listen."

"13 Hours 45 minutes," pronounced the familiar voice of the announcer of All-Union Radio Tamara Titova. She continued to announce precisely Moscow time at intervals of 3-4 seconds.

"Everything is clear," I guessed. "You recorded the speech of the announcer and, according to the readings of clocks, reproduce her words."

"Yes, but not quite," answered Kushtuyev. "The facts are a little different. Let us say, aircraft designers did not attempt to copy precisely the flight of birds. It is important only to understand its laws and then, relying on them, to design and develop modern flying vehicles. The same thing is true of human speech."

It turned out after long research that speech can be broken down into unique "audio cubes." The mass of words can be "composed" from a comparatively small number of them. If one takes into account that several hundred--a maximum of 1,000--words are quite sufficient for our daily needs, then the task becomes even simpler. We do not have to force the machine to synthesize the same words anew each time. The microprocessor analyzes the speaker's speech and determines and remembers the acoustic blocks together with the typical pitch and intonations. It then compiles from them according to a given program any sentences and makes announcements through a loudspeaker or earphones. Our "talking clocks" operate in just this manner.

I admit that I was unable to note, as much as a I wanted to, where the syllables were "woven" into words. But when the computer had become accustomed to my voice within several seconds, I lost my last doubts.

The new principle of speech synthesis has made it possible to reduce by several factors the dimensions and cost of units. These same "talking clocks" have become much less expensive than the most modern of similar devices now manufactured in the West. But the sphere of application of synthesizers is expanding at an explosive rate. Devices have already been manufactured that are hardly larger than a pack of cigarettes which warn pilots by voice about hazardous flight conditions. It has become possible to transmit more than tens of conversations simultaneously over an ordinary telephone channel--after all, short commands to the synthesizer rather than words themselves are transmitted. Finally, small electronic dictaphones (without a single moving part), capable of storing speech for hours, are next. The devices are reliable and essentlaly do not require maintenance.

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CSO: 1863/183

COMPUTER REPAIR AND MAINTENANCE IN USSR

Kishinev SOVETSKAYA MOLDAVIYA in Russian 17 Jan 86 p 1

[Article by I. Popov: "First Aid for Computers"]

[Text] This small plant was modestly constructed through the will of the designers in a previous vacant plot between the Kishinev taxi fleet and the Byk River. It is true not all residents of Kishinev know about its existence. But those who need to know do not have to look for it. They need only dial the telephone number.

"Hello. This is the computer hardware maintenance plant."

Inga Koroleva is answering the call for assistance. She is the distributor of operations of the computer section. And what she does from eight o'clock in the morning until the end of the shift is very similar to the work of a "First aid" dispatcher.

And many require help. Not people, but mini- and microcomputers. There is now no place where these small computers cannot be found! Of course, they do fail. This is a real misfortune. Bookkeepers who have forgotten their accounts have their hands tied. There are engineers, designers and statisticians. And the plant responds immediately: the malfunction will be corrected within 24 hours by specialists of the enterprise. This is a compulsory condition. And the quality of repair is a serious problem, but it does not exist. There are no complaints. There have been none for many years.

Computerization has not passed by the enterprise itself. An elegant dark-blue SM-1600, installed in the central laboratory, has already become an assistant to the plant. This is a computer with an excellent memory. It already stores, processes and outputs the necessary information about clients, about agreements with hundreds of institutions and enterprises for repair and maintenance of their "kinsmen"--computers. Valeriy Kozarenko, the chief of the laboratory, notes that the potential of the computer has been far from exhausted. In the future is automation of the remaining types of bookkeeping and accounting--calculations of wages and movement of material goods. And he then demonstrated an innovation--a personal computer with a display. About 30 of these computers will be located in two schools of the city. As soon as rooms are prepared for them, the first swallows of general educational computerization will fly to the classrooms.

"This is a serious and crucial matter," says the director of the plant G. Benzar. "And we are relating to it in the proper manner. This year we will equip and accept for maintenance more than one teaching classroom. Accordingly, we are preparing for this and we are training people. There is some favorable experience: 'computer auditoriums' have already been created by specialists of the plant at the Tiraspol Pedagogical Institute and at the Institute for Improving the Skills of Teachers. The innovation is not only in this, but also in the fact that we are solving a problem: conversion to repairless maintenance of computers. The repairmen will replace failed assemblies and units on the spot and repair will be performed under stationary conditions."

This is it--repair under stationary conditions: a light, shipshape shop. The repairmen wear white coveralls ("first aid"). Many of them have diplomas from higher educational institutions and technical schools and are on call. There is usually the slight odor of resin and smoke from the soldering iron at this plant.

My "guide" around the plant was the chief of OTiZ [Department of Labor and Wages] Anna Yakovlevna Buzover, and does not get into technology. She is concerned with something different--organization of the labor of people. And she talks about another innovation of the new five-year plan. Its essence is that there are 11 brigades at the plant instead of 43. But they are now integrated and consolidated brigades and cost-accounting has been introduced in them. There are no senior foremen or brigade leaders. There is only the master brigade repairman and he is subordinate only to the director. The "superstructure" has disappeared, so to speak. People, in executing the law of labor collectives, have taken on themselves part of the plant management. They themselves decide much: from problems of distribution of bonuses to purely specific and production problems. Problems are no longer considered privately in the narrow circle of the "brigade leader-foreman," but are put out for general discussion. It is already obvious that the new system has a positive effect on wages. And what will be the advantage to production and to the plant?

Here is the opinion of the director: "The main thing for us is that the client's needs be fulfilled on time with all pledges. The new organization of labor provides complete interchangeability of foremen in the section serviced by them and accordingly fulfillment of our indicator is number one."

As one assumes, an innovation is not easy. Indeed, before working out the regulations on integrated brigades under conditions of its own enterprise, A. Buzover and her assistants--P. Litvak, V. Tanas and Ye. Kolak--reviewed and processed over several months literally a mountain of different documents, newspapers and periodicals. The result is several typewritten pages. Goskomtrud SSSR [State Committee of the USSR Council of Ministers on Problems of Labor and Wages] did not become an assistant to the economists in this new matter. Although it should have. Even more so, since there are more than 40 plants similar to the Kishinev plant in the USSR and each of them must look for new forms of organization of labor on the basis of "inventing the bicycle." This "bicycle" is expensive to the state.

On the eve of the New Year at a meeting devoted to a modest anniversary--the 10th anniversary of the plant, G. Benzar read off the figures: the enterprise

serviced 276 units of typewriters, the simplest computer hardware and copying equipment during 1975. And now--more than 50,000. The plant has taken an enormous step forward, since it has rushed after the vigorously developing economy of the republic.

It has gone from adding machines to computers within 10 years. And this is only the beginning.

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STANDARD CONTRACT FOR COMPUTER SOFTWARE CONSUMERS

Moscow KHOZYAYSTVO I PRAVO in Russian No 12, Dec 85 pp 69-73

[Excerpts from a 27 August 1985 decree of the USSR State Board of Arbitration and the full text of a standard contract for rendering services to computer software consumers]

[Text] BY DECREE NUMBER 5 OF 27 AUGUST 1985 THE USSR STATE BOARD OF ARBITRATION APPROVED A STANDARD CONTRACT FOR RENDERING SCIENTIFIC AND TECHNICAL SERVICES TO COMPUTER SOFTWARE CONSUMERS.

THE DECREE (IN EXCERPT FORM) AND THE STANDARD CONTRACT ARE PUBLISHED BELOW.

The USSR State Board of Arbitration resolves:

1. To approve the accompanying standard contract for rendering scientific and technical services to computer software consumers for the period of validity of the decree on the development, production, delivery and use of computer software, as well as computer-aided systems and information processing systems, which was approved by decree number 41 dated 13 February 1984 of GKNT [State Committee for Science and Technology], USSR Gossnab, Gosstandart [State Committee for Standards], USSR Goskomtsen [State Committee on Prices], USSR Goskomtrud [State Committee for Labor and Social Problems], USSR Gosstroy, USSR TsSU [Central Statistical Administration], USSR Minfin [Ministry of Finance], Minradioprom [Ministry of the Radio Industry], Minpribor [Ministry of Instrument Making, Automation Equipment and Control Systems], Minelektronprom [Ministry of the Electronics Industry], and Minpromsvyazi [Ministry of the Communications Equipment Industry].

2. To establish that an association, enterprise, or organization who makes scientific and technical software services available--the "executors"--inform the associations, enterprises, institutions and organizations who use the services--the "consumers"--about the composition of services being made available by publishing a standard list of scientific and technical services being rendered or through some other method.

3. The "consumer," guided by the standard list of scientific and technical services being rendered, forwards a request to the "executor" for making the needed services available to him. On the basis of the "consumer's" request and

with regard to his production resources, the "executor" sends him a draft of the contract or a justifiable refusal to enter a contract within a 20-day period from the day of receiving the request.

Not later than 10 days following receipt of the draft contract the "consumer" signs it and returns 1 copy to the "executor."

4. Disagreements that arise at the time of concluding, changing and canceling the contract are resolved in accordance with the procedure established by section 4 of the "statute on the procedure for submitting and examining complaints by enterprises, organizations, and institutions and settling disagreements in terms of business contracts" that was approved by USSR Council of Ministers decree number 758 of 17 October 1973.

5. In terms of questions not settled by the standard contract for rendering scientific and technical services to computer software consumers, the parties are guided by the general norms of law and by standardized formal documents that are being approved by the USSR State Committee for Science and Technology.

STANDARD CONTRACT FOR RENDERING SCIENTIFIC AND TECHNICAL SERVICES TO COMPUTER SOFTWARE CONSUMERS

(Name of the association, enterprise, or organization making scientific and technical software services available) in the person of (position, last name, first name, patronymic) acting on the basis of (regulations, statute, etc.) henceforth called "executor," on the one hand, and (name of the association, enterprise, institution, or organization using scientific and technical software services) in the person of (position, last name, first name, patronymic) acting on the basis of (regulations, statute, etc.) henceforth called "consumer," on the other hand, entered the present contract on the following:

1. SUBJECT OF THE CONTRACT

1. In accordance with the "consumer's" task it is incumbent upon the "executor" to render scientific and technical computer software services (Footnote 1) (henceforth called "services") and it is incumbent upon the "consumer" to accept and pay for the services being rendered.

Composition of the scientific and technical services is determined in the list of software and services being rendered in accordance with the scientific and technical services contract (Footnote 2) (henceforth called "list") according to appendix number 1, which is an integral part of the contract. In this regard, the parties are guided by the standard list of services being rendered by the "executor," which is being developed by him in coordination with the USSR State Committee for Science and Technology and approved in accordance with established procedures.

The parties have the right to stipulate in the contract the making available of services that aren't stipulated by the standard list.

The software name and prices (payment scales) for services being rendered are indicated also in the list.

2. Rendering services according to the contract is accomplished in accordance with the schedule for conducting operations in rendering scientific and technical services (Footnote 3) (henceforth called "schedule") according to appendix number 2, which is an integral part of the contract.

The schedule for conducting operations is developed by the "executor" and is coordinated with the "consumer."

3. At the time of concluding a contract, the parties can coordinate additional conditions, which take into consideration the specific character of conducting operations and are determined by "additional conditions in implementing operations" (Footnote 4) (henceforth called "additional conditions") according to appendix number 3, which is an integral part of the contract.

4. Nonfulfillment or improper fulfillment of commitments according to the contract is confirmed by a bilateral formal document that is drawn up within a 5-day period from the day the deficiencies are detected. If the "executor's" or "consumer's" representative fails to appear or he refuses to participate in establishing the deficiencies, the formal document is drawn up with the participation of a competent public representative who is designated by the "executor's" or "consumer's" enterprise manager from among a number of persons who are approved by the trade union committee of the enterprise.

The formal document can be drawn up with the participation of a competent representative of another enterprise who is chosen by the manager of this enterprise in accordance with a request from the "executor's" or "consumer's" enterprise manager.

2. RESPONSIBILITIES AND RIGHTS OF THE "EXECUTOR"

5. It is incumbent upon the "executor" to fulfill the operations with quality, within the deadlines defined by the "schedule," and with regard to the regulations and requirements established at the "consumer's" enterprise.

6. In the event changes are introduced in the software by the "consumer" or it is passed on to other associations, enterprises, institutions and organizations without the "executor's" written permission, the latter has the right to cease the execution of commitments associated with rendering scientific and technical services for the above-mentioned software.

7. In the event of the "consumer's" nonfulfillment of commitments according to the contract or their execution is delayed over 1 month, the "executor" has the right:

--to postpone the deadline for implementing operations with the introduction of changes in the "schedule" that are coordinated with the "consumer,"

--to suspend operations,

--to demand cancellation of the contract, and

--to demand the reimbursement of costs associated with ceasing the implementation of operations or with postponing the deadline for implementing them.

8. In accordance with receipt of notification from the "consumer" concerning nonfulfillment or nonquality implementation of operations (paragraph 1 of the present standard contract), it is incumbent upon the "executor" to eliminate the noted deficiencies within a 3-day period or some other shortest, technically possible period that is coordinated with the parties.

9. The "executor" designates a responsible representative from among a number of his specialists for constant contact with the "consumer."

3. RESPONSIBILITIES AND RIGHTS OF THE "CONSUMER"

10. It is incumbent upon the "consumer:"

a. by the commencement of conducting operations that are established by the "schedule" to provide a given set of hardware in working condition, as well as a complex of software that is necessary for implementing operations according to the contract,

b. to present information that is necessary for turning over the software for operation,

c. to provide for the functioning of necessary hardware and software in accordance with the technical conditions in them,

d. to make available according to the "executor's" requests:

--computer time on an EVM [computer] (without payment) that is necessary for implementing operations,

--work accommodations for the "executor's" associates, and

--living accomodations for the "executor's" associates in a hotel or dormitory,

e. according to the "executor's" inquiry, to present information on use of the software and comments on its operation,

f. not to introduce changes in the software without the "executor's" written permission,

g. not to pass on the software to other associations, enterprises, institutions and organizations without the "executor's" written permission,

h. to use the software services with regard to regulations and requirements established at the "executor's" enterprise, and

i. to implement assimilation of the software that is received.

11. In the event of nonfulfillment or nonquality implementation of operations by the "executor," the "consumer" notifies him about this within a 2-day period from the day the deficiencies are detected.

When operations aren't implemented by the "executor" according to the contract or their implementation is delayed over 1 month, besides a penalty of fines that are provided for by the standard contract the "consumer" has the right to demand cancellation of the contract.

12. The "consumer" designates a responsible representative from among a number of his specialists for constant contact with the "executor."

4. PRICES AND CALCULATION PROCEDURE

13. Payment for operations implemented by the "executor" is made according to prices and established price lists approved by (name of the organ who approved the document, date of approval, number), and in case of the absence of an approved document it is made according to an estimated calculation that is developed in accordance with the State Committee on Prices decree number 789a of 25 September 1984 "instructions on the procedure for presenting, examining and approving wholesale price plans of industrial products for production and technical purposes" and coordinated with the parties.

14. Calculations are made upon termination of operations according to the contract on the basis of bilateral formal documents for delivery and acceptance of the implemented operations in a procedure stipulated by USSR Gosbank regulation number 2 by means of _____.

15. The sum total according to the contract is (in words) _____ rubles.

5. RESPONSIBILITY OF THE PARTIES

16. The "executor" pays the "consumer:"

a. a fine in the amount of 25 rubles for each day of the delay, but no more than 500 rubles, for violation of deadlines in conducting operations to render scientific and technical services established by the "schedule" and "additional conditions," as well as for the nonelimination of deficiencies (paragraph 8 of the present standard contract) within the established deadline, and

b. a fine in the amount of 100 rubles for each occurrence for nonquality implementation of operations.

17. The "consumer" pays the "executor:"

a. a fine in the amount of 100 rubles for each noted occurrence for improper fulfillment of contractual commitments and (or) deviation through the fault of the "consumer" from the "schedule" and "additional conditions,"

b. a fine in the amount of 100 rubles for each occurrence for introducing changes in the software without the "executor's" written permission, and

c. a fine in the amount of 100 percent of the cost of the software that was passed on for sending the software to other associations, enterprises, institutions and organizations without the "executor's" written permission.

18. Irrespective of the payment of a fine, the party who has violated the conditions of the contract reimburses the other party for financial losses caused as a result of this on the portion not covered by a fine.

19. The payment of fines and reimbursement for financial losses do not release the parties from fulfilling their commitments according to the contract.

6. PROCEDURE FOR RESOLVING ARGUMENTS

20. Arguments of a scientific and technical nature are resolved by the parties' higher organizations.

21. Arguments that arise at the time of executing a contract for rendering scientific and technical services are resolved in accordance with established legal procedures.

22. In the event of cancellation of the contract, the guilty party pays the other party all actual costs that arose on the point of ceasing contractual commitments, and it presents a report (formal document) on the portion of the job that was performed.

7. THE CONTRACT'S PERIOD OF VALIDITY AND LEGAL ADDRESSES OF THE PARTIES

23. The contract's period of validity is established for _____ years (from " " 198- to " " 198-) with an annual refinement, in accordance with established procedures, of the software products list and the list, cost, and periods of services being rendered.

24. The contract is considered as extended for the next term if neither one of the parties declares his disagreement with extending the contract for ___ months until expiration of its period of validity.

25. In terms of questions that are associated with fulfilling commitments according to the present contract, the following are responsible representatives:

--from the "executor:" (position, last name, first name, patronymic, business telephone), and

--from the "consumer:" (position, last name, first name, patronymic, official telephone.

26. "Executor:" The enterprise's nationwide classifier code--

--Postal address _____

--Teletype _____

--Current account _____

--MFO [interbranch turnovers] in the Gosbank department _____

27. "Consumer" (names are filled in by the "consumer")

--(name of the republic) (code)

--(name of the ministry) (code)

--(name of the all-union association) (code)

--(index) (city)

--(postal address)

--(teletype) (manager of the organization) (work telephone)

--(current account with the MFO sign, their code, Gosbank department)

28. It is incumbent upon the parties to notify each other immediately concerning a change of address or account at the bank.

29. The following are affixed to the contract:

1. A list of software and scientific and technical services being rendered according to the contract,

2. A schedule for conducting operations to render scientific and technical services, and

3. Additional conditions for the implementation of operations.

"Executor"	"Consumer"
" " 198-	" " 198-
M. P. [place for seal]	M. P.

Appendix 1. List of Software and Scientific and Technical Services Being Rendered According to the Contract

(1) №№ п/п	(2) Регистрационный номер программного средства	(3) Наименование программного средства	(4) Наименование оказываемых услуг	(5) Объем программных средств	(6) Цена (тариф) за услуги	(7) Наименование документа, орган и дата утверждения цены (тарифа)	(8) Примечание

(9) «Исполнитель» (10) «Потребитель»

Key:

1. Numbers, paragraphs
2. Software registration number
3. Software name
4. Name of services being rendered
5. Software volume
6. Price (payment scale) for services
7. Document name, organ, and date of price (payment scale) approval
8. Comments
9. "Executor"
10. "Consumer"

Appendix 2. Schedule for Conducting Operations to Render Scientific and Technical Services

Software (name) _____
Software code _____
Software modification _____

(1) №№ п/п	(2) Перечень работ	(3) Код работы	(4) Ответственный исполнитель	(5) Сроки проведения работ		(6) Отчетный документ о проведении работ	(7) Примечание
				(8) начало	(9) окончание		

(10) «Исполнитель» (11) «Потребитель»

Key:

1. Numbers, paragraphs
2. List of operations
3. Work code
4. Responsible executive
5. Periods for conducting operations
6. Summary document on conducting operations
7. Comments
8. Commencement
9. Conclusion
10. "Executor"
11. "Consumer"

Appendix 3. Additional Conditions for Implementation of Operations

(1) №№ п/п	(2) Содержание условий	(3) Срок выполнения	(4) Сторона, ответственная за выполнение условий	(5) Примечание
(6) «Исполнитель»				(7) «Потребитель»

Key:

1. Numbers, paragraphs
2. Composition of conditions
3. Implementation period
4. Party responsible for implementation of conditions
5. Comments
6. "Executor"
7. "Consumer"

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UDC 519.95

IMPLEMENTATION OF SAFE PETRI NETS BY SEQUENTIAL MACHINES

Moscow MINSK DOKLADY AKADEMII NAUK BSSR in Russian Vol 30, No 2, Feb 86 pp 120-123

[Article by A. D. Zakrevskiy of the Institute of Technical Cybernetics, Belorussian SSR Academy of Sciences]

[Text] The most difficult part of the problem of sequential implementation of safe Petri nets is the minimization of the number of Boolean variables used for the place assignment. An approach to its solution is proposed.

The apparatus of Petri nets, especially safe Petri nets, is widely used in the theory of parallel algorithms [1,2]. In particular, the structure of logical control algorithms constitutes such nets. The synthesis of a digital device whose behavior is determined by a given control algorithm encounters the problem of constructing a sequential machine to implement the Petri net corresponding to the algorithm [3,4]. In the present paper, this problem is clarified and additional possibilities defined for minimizing the number of Boolean variables in the implementing machine.

A safe Petri net is a discrete dynamic model M, which can be represented as a finite set of locations $P = \{p_1, p_2, \ldots, p_h\}$, the set of transfers $T = \{\tau_1, \tau_2, \ldots, \tau_m\}$, where $\tau_i = \mu_i \to \nu_i$ and $\mu_i, \nu_i \subseteq P$, and the initial arrangement N_0, $N_0 \subseteq P$. The behavior of this model is examined in discrete time and expressed by an alteration of the current arrangement N_t, which has the value N_0 at the start. At time t, any transfer, but only one, may be performed, for which $\mu_i \subseteq N_t$. This operation involves replacement of N_t by $N_{t+1} = (N_t \setminus \mu_i) \cup \nu_i$. In a safe Petri net, the condition always obtains $(N_t \setminus \mu_i) \cap \nu_i = \emptyset$.

The transfers ν_i and ν_j for which the condition obtains $\mu_i \cap \mu_j = \emptyset$ and for which there exists an arrangement N_t, reachable from N_0, such that $\mu_i \cup \mu_j \subseteq N_t$, shall be known as parallel.

A sequential machine, or system of sequences S, is a model used in the description of the behavior of a digital device with Boolean variables, the values of which are usually set by flip flops. This consists of the sequences $f_i \vdash k_i$, $i = 1,2,\ldots,\ell$, where f_i is an arbitrary Boolean function $f_i(\underline{x}) = f_i(x_1,x_2,\ldots,x_n)$, while k_i is an elementary conjunction on $\underline{x}$. The behavior of this model is also examined in discrete time. We shall assume that any (but only one) sequence in which $f_i = 1$ may be performed at the actual moment. By the next moment of time, the variables constituting k_i take on values converting k_i to one, while the others retain their values. We shall further assume that the machine is autonomic. This means that all the variables $x_1,x_2,\ldots,x_n$ may only change value when certain sequences are performed.

To each location p_j of the safe Petri net M we assign a Boolean function $\phi_j(\underline{x})$, assuming that the machine S exists in a partial state γ_j if $\phi_j = 1$. We define the full state of the machine S as the set of partial states in which the machine exists simultaneously. We shall consider that a full state of the machine maps the arrangement N_t of the Petri net M if it is comprised of partial states γ_j corresponding to the locations p_j belonging to this arrangement.

We shall say that a sequential machine S implements a safe Petri net M if the graph of possible transfers between full states of the machine S is isomorphic with the graph of transfers between arrangements of the Petri net M, whereby the arrangements correspond to the full states mapping them.

Let us consider the problem of constructing a sequential machine with minimum number of variables, implementing a specified safe Petri net.

We shall look for the solution in the class of such sequential machines where $\ell = m$ and the sequences $s_i = f_i \vdash k_i$ model the corresponding transfers $\tau_i = \mu_i \rightarrow \nu_i$ of possible arrangements. Two conditions should be granted for this modeling. First, the sequence s_i may be performed in a certain full state of the machine S if (and only if) the transfer τ_i can be performed in the arrangement mapped by this state. This condition is easy to assure by defining the Boolean function f_i as the conjunction of the functions ϕ_j corresponding to the locations p_j belonging to the set μ_i. Second, in performing the sequence s_i the function ϕ_j corresponding to the location p_j should take on the value 1 if $p_j \in \nu_i \setminus \mu_i$; the value 0 if $p_j \in \mu_i \setminus \nu_i$; or retain its previous value in other situations. The second condition is granted by appropriate choice of the system of functions ϕ_j and elementary conjunction k_i, but this is a more complicated problem.

Hereafter, we shall assume that the elementary conjunction k_i is nonredundant: if any literal is removed from it, the sequence s_i will no longer model the corresponding transfer τ_i.

Two activities take place in the performance of the sequences: recognition of the states and control of them. The recognition capabilities are in no way restricted, since the functions f_i are optional. But the control may not be arbitrary, for it is exercised exclusively by assigning certain values to the group of variables comprising the elementary conjunction k_i (we shall designate this set of variables by δ_i). It is this fact which generally prevents lowering of the number of variables in a sequential machine to the level $]\log_2 L[$, where L is the number of reachable arrangements in the Petri net being implemented. Change in the values of the variables constituting k_i reflects a change in position of certain locations of the Petri net being implemented under the current arrangement. The set of such locations, corresponding to the transfer τ_i shall be designated by π_i:

$$\pi_i = \mu_i \oplus \nu_i = \mu_i \setminus \nu_i \cup \nu_i \setminus \mu_i.$$

Theorem 1. If the transfers τ_i and τ_j of a safe Petri net are parallel, they connect the nonintersecting groups of locations:

$$(\mu_i \cup \nu_i) \cap (\mu_j \cup \nu_j) = \varnothing.$$

Proof. By definition, for parallel transfers τ_i and τ_j we have $\mu_i \cap \mu_j = \emptyset$, while the property of safety infers the relations $\mu_i \cap \nu_j = \emptyset$, $\mu_j \cap \nu_i = \emptyset$ and $\nu_i \cap \nu_j = \emptyset$.

It follows from theorem 1 that, for parallel transfers τ_i and τ_j in a safe Petri net, $\pi_i \cap \pi_j = \emptyset$.

Theorem 2. If the sequences s_i and s_j respectively model the parallel transfers τ_i and τ_j, then $\delta_i \cap \delta_j = \emptyset$.

The process of finding the functions ϕ_j corresponding to the locations p_j of a safe Petri net shall be known as the coding of locations. The coding methods described in [3-6] may be known as interval methods, as the functions ϕ_j are chosen in the class of elementary conjunctions. These methods, while quite practical, do not assure a minimum number of coding variables. Accordingly, we propose a more "economical" coding technique, convenient to the discussion

of parallel-sequential Petri nets obtained from automatic nets by a series of operations of sequential and parallel connection.

Let the Petri net be formed from two automatic nets A and B, connected in parallel: the corresponding sets of locations P_A and P_B do not intersect, while the initial arrangement of the net consists of two locations, one of which belongs to P_A, the other to P_B. For interval coding, the locations p_i and p_j of the blocks A and B, respectively, are represented by full elementary conjunctions $k_i(\underline{u})$ and $k_j(\underline{v})$ on nonintersecting sets of Boolean variables. In this case:

$$|\mathbf{u}| =]\log_2|P_A|[\quad \text{and} \quad |\mathbf{v}| =]\log_2|P_B|[.$$

The arrangement of the net is entirely mapped by the function $k_i(\underline{u})k_j(\underline{v})$.

We introduce the Boolean functions:

$$g_A(\mathbf{u}) = \bigvee_{p_i \in P_A} k_i(\mathbf{u}), \qquad g_B(\mathbf{v}) = \bigvee_{p_j \in P_B} k_j(\mathbf{v})$$

and we shall code the locations p_i of the block A by the functions $\phi_i = k_i(\underline{u})g_B(\underline{v})$, and the locations of block B by the functions $\phi_j = k_j(\underline{v})g_A(\underline{u})$. Since

$$k_i(\mathbf{u}) \Rightarrow g_A(\mathbf{u}) \text{ and } k_j(\mathbf{v}) \Rightarrow g_B(\mathbf{v}),$$

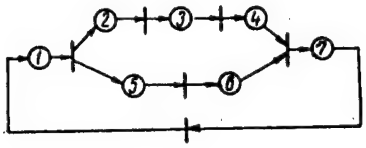
the arrangement of the net, as previously, will be entirely mapped by the function $k_i(\underline{u})k_j(\underline{v})$. In the modeling of the transfers, a distinction applies to the operation of recognition of the state of the sequential machine: it is somewhat more complicated. On the other hand, the coding becomes more economical, since the characteristic sets of functions ϕ_j are abbreviated in the general case and the "economized" region of Boolean space may be used to code locations belonging to other blocks of the Petri net.

Let us consider a Petri net formed of automatic nets A, B and C, the structure of the mutual connection of which is given by the formula A·B + C: the blocks A and B are connected in parallel, while block C is connected in sequence with them. Let the locations of the blocks A and B be coded in the above-described manner.

Theorem 3. If

$$|P_C| \leqslant 2^{|\mathbf{u}\cup\mathbf{v}|} - |P_A| \cdot |P_B|,$$

the coding of the locations of block C can be done without introducing additional variables, using instead the full elementary conjunctions $k_i(\underline{u},\underline{v})$, such that $k_i(\underline{u},\underline{v})g_A(\underline{u})g_B(\underline{v}) = 0$.



A Petri net

The corresponding example is shown in the figure, where $P_A = \{2,3,4\}$, $P_B = \{5,6\}$ and $P_C = \{1,7\}$. To code the locations of this net, we use three Boolean variables: $\underline{u} = (r,s)$, $\underline{v} = (t)$. The functions ϕ_j are selected as:

$$\varphi_2 = \bar{r}s, \quad \varphi_3 = rs, \quad \varphi_4 = r\bar{s},$$
$$\varphi_5 = \bar{t}(r \vee s), \quad \varphi_6 = t(r \vee s),$$
$$\varphi_1 = \bar{r}\,\bar{s}\,\bar{t}, \quad \varphi_7 = \bar{r}\,\bar{s}t.$$

Modeling the transfers by the appropriate sequences and simplifying the latter, we construct a sequential machine to implement the specified Petri net:

Transfers	Sequences
$1 \to 2.5$	$\bar{r}\bar{t} \vdash s$
$2 \to 3$	$s \vdash r$
$3 \to 4$	$r \vdash \bar{s}$
$5 \to 6$	$r \vee s \vdash t$
$4.6 \to 7$	$\bar{s}t \vdash \bar{r}$
$7 \to 1$	$\bar{r}\bar{s} \vdash \bar{t}$

(e.g., the transfer $1 \to 2.5$ is modeled by the sequence $\phi_1 \vdash \phi_2 \wedge \phi_5$, i.e., the sequence $\overline{rst} \vdash \bar{r}\bar{s}\bar{t}(r \vee s)$, simplified to $\overline{rt} \vdash s$).

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12717
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APPLICATIONS

COMPUTER DEVELOPMENT IN AGRICULTURE OF UZBEK SSR

Tashkent PRAVDA VOSTOKA in Russian 15 Mar 86 p 2

[Article by UzTAG correspondent O. Lukyanchikov: "The Computer and Reclamation Work"]

[Text] There is encoded information in the rows of characters on the teletype programs. Having run her fingers over the display keyboard, the senior engineer-programmer Rashida Uybikova enters incoming data into the computer. The green numbers are arranged on the screen in tables and columns. Based on them, the computer issues a forecast about the farms being supplied with irrigation water during the spring season.

We are in one of the computer rooms of the information computer center of the Ministry of Reclamation and Water Economy, Uzbek SSR. The third stage of the sector automated system Uzvodkhoz has been introduced here. It solves 260 tasks, among which the main ones are distribution of water and monitoring its use. The water-management strategy of the republic and this means to a large extent the strategy for development of its economy as a whole depends largely on solution of these tasks.

"Operational tasks now 'spin' on the machines," says the deputy director of the Information Computer Center A. A. Atamas. "They have been entrusted with compiling summaries of the course of seasonal operations--flushing and reserve irrigations, filling reservoirs and so on. The computer generalizes and classifies data and gives advice in some cases--how to optimize management of the republic's water resources."

The land reclamation specialists of Uzbekistan were pioneers in developing means of automation and telemechanics for water management. Development and introduction of them began here for the first time in the country 25 years ago. During this time a strong scientific industrial base of irrigation automation and telemechanics has been developed in the republic and the complete cycle of developing it has been assimilated from the idea to serial output. Water meters and other products of the Planning and Design Production Office Uzvodpriboravtomatika [not further identified], of the Association Vodremstroymash, are also in demand outside the republic.

More than 1,000 kilometers of large major canals and five reservoirs have now been converted to telemechanical monitoring and control in Uzbekistan and 45 telemechanical units are in operation. The local water management systems of the administration are entering a qualitatively new phase, related to the use of the computer technology. A computer has been installed on the major Miankal-Khatyrchinsk Canal that permits it to be operated in the automatic mode. A computer has also been installed in the control system of the Bolshoy Fergana Canal.

The idea of managing the waters of entire rivers at a distance has also taken root. An automated management system of the water resources of the Syr-Darya River basin is being developed. It monitors all the major water-intake facilities on the river. The rates of construction and installation work on sections of the river in Syr-Darya and Tashkent oblasts are being increased. A similar version for the Amu-Darya basin is next.

"Automated systems now make it possible to conserve many thousand cubic meters of water," says the chief of the Main Administration of Electric Networks, Minvodkhoz [Ministry of Water Management], Uzbek SSR Sh. Sh. Shaismailov.

But the saving due to automation and computer technology in water management could be considerably higher. The old dispatcher service and the new system are duplicating each other in Minvodkhoz of the republic. A written log, where data are collected over the telephone, is maintained in parallel with many summaries which the computer processes. The automated system Uzvodkhoz duplicates the traditional methods of management, the existing structure of the apparatus and is adapted to its multilayered structure.

The fourth stage of the ASU has been called on to eliminate these deficiencies. It will be based on a unified electronic database with outputs to individual displays. All information will begin to arrive through the management information computer center directly to the computer and will be used in direct interaction with it. It is natural that the communications equipment must essentially be improved and that direct intercomputer contact of the information computer center be organized with the electronic units at the water management facilities. The capability of releasing hundreds of people from performing mechanical, routine work and of reducing the excessive links of the management apparatus has been revealed. The decisions of the 27th CPSU Congress must be directed toward this very purpose.

There is yet another problem. Not one of the higher educational institutions of the republic is training specialists to operate automated systems in water management. The water reclamation specialists, graduating from the Tashkent Institute of Irrigation Engineers and Agricultural Mechanization, receive too little knowledge in automation. Time dictates the need to create a VUZ specialty at the juncture of these two sciences.

Touching the display key sets the computer printer in operation. The next flowchart is transferred to paper. The future of millions of cubic meters of water in rivers and canals, in the beds of artificial seas and in irrigation furrows on fields can be seen on this sheet; it contains the guarantee of thrifty use of this great treasure.

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PROBLEMS IN UkSSR AUTOMATION OF PLANNING CALCULATIONS

Kiev EKONOMIKA SOVETSKOY UKRAINY in Russian No 12, Dec 85 pp 3-11

[Article by Doctor of Economic Sciences Professor M. Matveyev, director of the main scientific research and information computer center, and Candidate of Economic Sciences S. Kamenetskiy: "Problems in Developing and Increasing the Efficiency of Ukrainian SSR ASPR [Automated Control Systems for Planning Calculations"]

[Text] The modern period for improving planning management of the economic system requires increased attention toward the prospects and trends of further using electronic computer technology and automated systems in planning activities. In the draft of basic trends of economic and social development in the USSR during the 1986-1990 period and for the period until the year 2000--a document of enormous political importance, it pointed out the necessity for vigorously raising the role of science and technology in a qualitative transformation of productive forces. The task is set to provide for an increase in the production volume of computer technology by a factor of 2-2.3, through high growth rates to increase the scales of using state-of-the-art, highly productive electronic computers, and to increase the operating efficiency of computer centers.

The use of computer technology in planning is accomplished within the framework of ASPR of USSR Gosplan and the state planning committees of union republics and local planning organs. A feature of ASPR development in the UkSSR is the direct orientation of its basic composition towards the generation and analytical study of indicators and forms for drafts of state plans. Optimization, predictive-analytical, and other tasks are connected to these calculations that comprise the framework of the system at individual key points associated with the making of planning decisions. A rather large information-computer system, which includes nearly 3,000 tasks that are being used at all stages in working on the plan, was created as a result, including:

--during the justification stage of the draft plan, a printout in terms of inquiries of sizable volumes of reference and analytical information by accumulating in the memory of an EVM [computer] predictions according to a number of the most important trends of the republic's economic and social development (demography, scientific and technical progress, key indicators of social development and an increase in the people's standard of living, and others),

--during the stage of directly compiling indicators and forms of the draft plan, a work-up on a computer of more than 70 percent of the planning forms and the inclusion of approximately one-third of their total number in final documentation of the draft plan in a computer format,

--during the stage of bringing the plan to executors, the performance on a computer of labor-intensive operations in generating excerpts from the plan for the republic's ministries and departments according to a number of the most important sections (in 1985, 58 percent of the total number of plan documents were outputted from a computer), and

--during the stage of monitoring fulfillment of the plan, a monthly operational check on fulfillment of the plan (first of all according to sectors of industry) in terms of a range of the most important volume and qualitative indicators (nearly 2,000 designations) in a cross section of UkSSR ministries and departments and in terms of industry of union subordination.

As a whole in terms of ASPR of UkSSR Gosplan, large-scale calculations that are associated with processing large volumes of planning and statistical information generate nearly 40 percent of the tasks, and nearly 30 percent are generated by calculations of an over-all generalized nature, the performance of which on a computer provides a noticeable advantage in time and in the accuracy of results as compared with manual procedures.

The techniques and processing methods of planning were improved as a result of introducing and developing ASPR in many sections of planning work. Recently, the technique of balance sheet planning in the "consolidated national economic plan" subsystem was improved on the basis of using computers. Instead of consolidated calculations of the national economy's balance sheet according to an abbreviated configuration, indicators are worked out according to an expanded configuration that includes detailed calculations of indicators in a cross section of industries of the national economy. Mutual conformity of the composition and structure of planning and summary-statistical information that is received from the UkSSR TsSU [central statistical administration], as well as coordination with calculations that are being performed in industrial departments of the republic's Gosplan, are provided for in this regard.

Completeness has increased in working out a draft plan for social development and an increase in the people's standard of living by implementing information and algorithmic linkages of task complexes for the generation of a planning balance sheet of the public's monetary income and expenditures, as well as coordination with calculations of commodity turnover indicators of state and cooperative trade, the implementation volume of domestic services, and the development of a network of public health care, education, and cultural institutions.

Centralization in developing and using a task complex for calculations of a draft plan for industrial production provided coordination all the way through and, on this basis, an improvement in coordinating the generation of indicators for the use of production capacities, output production in physical terms, and

commodity and implementable production and for the use of industrial fixed capital at industry and consolidated levels.

The development of science and technology is planned in a more valid manner by automating procedures for analyzing the development level of science and technology, accomplishing predictive calculations of indicators of scientific and technical progress, generating a standardized basis for determining development indicators of science and technology, and making alternative calculations of the draft plan on the basis of using a data base that consists of more than 3 million indicators.

By the end of the current five-year plan, ASPRO [automated design systems] will be functioning at the oblast level in a number of oblast planning commissions, as well as in the Kiev and Sevastopol city planning commissions. In the basic oblasts ASPRO provide the justification and presentation in the required manner of more than 70 planning forms for the draft of the annual plan and nearly 20 planning forms for drafts of five-year and long range plans (35 percent and 25 percent of the total number respectively). In the remaining oblast planning commissions where the creation of ASPRO was begun only during the current five-year plan, these figures are slightly lower. Information and computer centers of oblast planning commissions are equipped with minicomputers. At the present time, these computers are being used already in a number of oblast planning commissions, and in the near term one minicomputer each will be installed in all the republic's oblast planning commissions. Intercomputer interaction on the most important calculations being performed at the levels of UkSSR Gosplan ASPR and ASPRO is being expanded. Training of staff members of oblast planning commissions to operate minicomputers is being conducted.

UkSSR Gosplan ASPR--which can be described as a large electronic data processing and storage system that functions mainly in a batch mode (and only experimentally in a remote interactive mode) basically with its own preparation of data for computer input primarily on magnetic tapes (ML) and with partial receipt on ML of data for processing from other systems and by communications channels with an accumulated, utilized, and controlled data bank--is the most developed part of the republic ASPR.

From the point of view of existing requirements and systematic presentations, ASPR is a highly efficient system, and first and foremost in terms of indicators of economic efficiency. Thus, for example, the efficiency coefficient of expenditures for the development of ASPR during the 11th Five-Year Plan is almost twice the standard value.

At the same time, UkSSR Gosplan ASPR has a number of deficiencies and imperfections, which in particular are the result of a lack of some necessary means and resources.

The weakest point in operating the system is insufficient reliability of some hardware being used. The way to improving the system's reliability is the creation of a unified multicomputer complex with developed means for multicomputer operation and firmware control. This work is being completed by

GlavNIIVTs [Main Administration of the Scientific Research Institute for Computer Centers] of UkSSR Gosplan.

The created system isn't flexible enough and for the time being its software doesn't allow it to be adapted in a practical manner to continuously occurring changes in planning forms and techniques for the determination of planning indicators. In spite of the development of operations for organizing interaction of the republic's Gosplan ASPR with external ASU [automated control systems], as before a predominant portion of the tasks is provided by initial data through the republic's Gosplan organization, and that leads to an increase in the additional routine load on planning workers. The system doesn't have the necessary means for filling out and circulating the final planning documents.

As was noted already, the system's operation is accomplished only in the batch mode of data processing. For the time being, as a functioning prerequisite of ASPR on a real time scale for the development of plans, the remote interactive mode is being implemented only in an experimental manner. Its software and hardware, including means for protecting data, still require considerable refinements.

In the functional portion of UkSSR Gosplan ASPR a quite developed automated processing method for solving individual, including large, task complexes is combined with traditional (not automated) methods for correlating and coordinating planning solutions between Gosplan subunits [podrazdeleniye], and that causes an even lower integration level of planning calculations, which doesn't provide proper improvement in the balancing of draft plans that are being developed on the whole.

In work with OASU [automated control system for a sector of industry] of ministries and departments, the development of standardized planning solutions hasn't obtained necessary development for the level of OASU in terms of tasks that are included among a number of important sections of the plan. The systematic, economic, mathematical and information arsenals of UkSSR Gosplan ASPR aren't developed enough for implementing a multivariant work-up of draft plans and selecting the best variants.

In spite of the noted imperfections, an operating ASPR can serve as a sufficient starting base for further developing and improving the automation of planning calculations on the principles of integration. A number of basically important components that play the role of pivotal points for its further development (central and other systems task complexes, an automated complex structure data bank, special linguistic query systems, data exchange on ML and by communications channels, and others) was created in the composition of UkSSR ASPR.

The basic objective in developing ASPR for the long term will consist of providing a further increase in the quality of plans that are being developed at all levels of management: a maximum approach to directive socioeconomic objectives for developing the national economy; an improvement in the degree of balancing; selection of the best, as regards certain criteria, variants of plans that are constructed on the basis of an advanced standardized base and that have a high probability of implementation in practically any production, economic, natural, or other conditions and situations.

In order to fulfill this purpose, for the long term ASPR logically must be defined as a multilevel, intercomputer, and human-computer interactive system for special multivariant planning in which the basic volume (more than 90 percent) of data circulates in its computer portion, i. e. the ASPR must be developed on the principles of "low-paper computerized information processing" and be the material and technical link of new automated interactive processing methods for variant development of national economic plans.

The provision of purposeful variability for the development of plans should be singled out as one of the pivotal trends in the development of ASPR, which on the one hand results from features in improving the economic mechanism on the principles of more efficiently combining centralized planning with economic independence and initiative locally, and on the other hand it results from the positions of cybernetic theory on improving the output of any system by reducing the level of its lack of orderliness (entropy) on the basis of an increase in volumes and quality of the required planning information.

Intensification of the independence of enterprises will give rise to the necessity of examining and assessing, according to each project, several possible variants for production development. Therefore, at the central planning organs it's necessary to create and work out effective methods for summarizing draft plans that are received "from below" and a systematic apparatus for purposefully studying and selecting their best variants, as well as to provide balancing and coordination of economic parameters on the scale of the economy as a whole.

A number of features are typical of an organizational and systematic configuration for a multivariant work-up of draft plans with the use of computers in a multilevel system (ASU of enterprises and production associations; OASU of ministries; ASPR of the republic's Gosplan):

--sequentially generating variants of draft plans at each of the levels of a planning system on the basis of the aggregation of information that is received from planning organs of a lower level,

--developing no less than two variants of a draft plan (their total number can be any number under conditions of differences in terms of the main variable indicators for quantities that exceed the accepted degrees of accuracy of their calculations) at each level in principle.

--using volumes of output production, services, or operations as a main variable parameter at the enterprise and industry level, and at the national economic republic level using indicators of volumes and structure of the gross national product with regard to the possibilities of best satisfying the public's social and personal demands,

--optimizing variants of a draft plan according to criteria that describe proportionate costs and the effectiveness of using basic resources (labor, energy, fuel, materials, fixed capital),

--providing interlevel criterion coordination on the basis of comparability (compatibility) of appropriate indicators that are included among the various levels,

--imposing limitations with the optimization of variants of draft plans only on resources that are at the complete disposal of a given planning project with a mandatory determination of demands for all resources that are being limited by higher levels of management according to each optimizable draft plan, and

--coordinating the territorial and industrial aspects of draft plans by initial determination according to conditions--a region's limitations on enterprises and associations that are located in its territory--and by a certain acceptable set of variants of draft plans on the basis of which variants of ministry and department plans will be generated with an orientation towards a minimum acceptable, average, and maximum possible level of output production, operations, and services in the region with regards to limitations only on resources that the region places at one's disposal and with the use, when selecting variants of a plan, of criteria that are of basically great importance for the region. When compiling variants of plans at the level of union and union republic ministries, the selection of draft plans of enterprises and associations must be done from a number of variants that meet regional limitations. Variants that are acceptable from the positions of demands of both industries and regions are selected at the unionwide level.

The industrial process of selecting and combining variants of draft plans must accomplished by data queries from a computer memory. When there is insufficient data for generating a solution, the system must supplement it from the ASU memory of higher levels and on this basis generate an additional set of plan variants in which the desired variant will be located with a high fraction of probability.

The creation of new multilevel interactive processing methods for planning is an extraordinarily complex and labor-intensive problem. The very necessity of providing for natural development without cardinal breaks and discontinuing the operation of a system that is created already makes it even more complex. Therefore, during the 12th Five-Year Plan it's most advisable to conduct appropriate operations in the following directions.

The first direction is the continuation and intensification of operations for integrating ASPR with transfer of the center of gravity to intersubsystem (between different sections of the plan that are being developed by individual ASPR subsystems) and intersystem (ASPR of the republic's Gosplan, OASU of ministries and departments, and ASPR of oblasts) integration of tasks. As experience of the previous development of ASPR showed, the introduction of even large and industrially developed task complexes within the framework of individual subsystems, i. e. within the limits of functions of specific departments or subdepartments of Gosplan, is of only local importance from the point of view of improving the processing methods of planning, not leading to the creation of comprehensive automated processing methods of planning that are based on the start-to-finish automation of processes for joining, coordinating, and correlating different sections and parts of a draft plan as an integrated whole. In UkSSR Gosplan ASPR the intersubsystem integration of tasks is accomplished now within the framework of several large blocks, which conform to the plan's parts that are different in terms of economic contents. Each of the blocks can be considered as the nucleus for integrating a certain comparatively large portion

of planning calculations. Data interrelationships are active between the individual blocks, however, they're of the most intensive nature within blocks--between the tasks of each integration nucleus.

During the 12th Five-Year Plan it's necessary on this systematic basis to conduct operations according to several basic intersystems task complexes, in terms of a portion from which assimilation was begun during the current five-year plan and in terms of another portion developments were conducted all over again.

The following are included among a number of complexes of a type like this:

1. A central task complex (TsKZ) that is the center for integrating calculations of production indicators and final consumption of the national product at national economic, industrial, and departmental levels. The TsKZ combines tasks of "consolidated national economic plan" (the "national economic balance" block), "industry," "agriculture" (the "production" blocks), "consumer services," "trade," "public health care," "education and culture" ("basic activities" blocks), and "people's standard of living" subsystems in coordination with calculations at the level of ministry and department OASU and with the output of results of all calculations for generating a system of basic indicators of the republic's economic and social development.

2. A complex for "planning and predicting the development of science and technology" that is being created for purposes of centralized development and coordination of consolidated and industrial tasks according to predictive, analytical, and planning calculations for the development of science and technology at the republic's Gosplan level in coordination with appropriate tasks of UkSSR ministry and department OASU. Within the framework of creating this complex, methods must be worked out that are being implemented by means of computers for determining the impact of NTP [industrial planning norms] on indicators of labor productivity, production cost, and its production volumes on the basis of coordination with the tasks of appropriate ASPR subsystems.

3. A "unified system for planning capital construction" [YeSPKS], which is a complex that combines industrial and consolidated tasks for planning, analyzing, and predicting capital investments in coordination with the planning of project survey operations, as well as calculations of the volumes of construction and installation operations, the capacities of contract construction organizations, and the capacities of the production and industrial construction base in territorial and departmental cross sections on the basis of creating a unified data base on the levels of UkSSR Gosplan ASPR and UkSSR ministry and department OASU.

4. An "agro-industrial complex" that is being created in UkSSR ASPR on the basis of balanced coordination of tasks of the "agricultural" and "food industry" subsystems.

5. A complex of "material and technical support," within the framework of which tasks of UkSSR Gosplan ASPR and ministry and department OASU that implement centralized calculations of the republic's demand for material and technical resources are combined, the generation of a standardized base for nonrequest planning of material and technical support, and calculations of indicators of

material balances and distribution plans in coordination with planning the volumes of industrial production.

6. A "comprehensive territorial plan," which includes tasks of UkSSR Gosplan ASPR, ministry and department OASU, and oblast ASPR that implement planning and multilevel balancing of indicators of production and social infrastructure on the oblast, economic region, and republic level as a whole.

7. A "consolidated balance of labor resources" complex that contains tasks for generating consolidated and special balances of labor resources of UkSSR oblasts and the republic as a whole in coordination with tasks of demographic calculations.

8. A "monitoring" complex that includes tasks for monitoring the fulfillment of a plan, as well as the analysis and anticipated fulfillment of a plan at industry and consolidated levels with the use of a distributed data bank and the remote access of UkSSR Gosplan specialists to data bases.

In an organizational plan the planning and assimilation of systems task complexes assume considerable centralization of planning and assimilation operations with stricter management of processes in the development of tasks of functional subsystems that are being encompassed by systems complexes. In addition, the necessity is appearing to solve the fundamental problem of organizationally including the planning subsystems of ministry and department OASU in the republic's ASPR, and that will allow the head organization in developing ASPR to provide more precise coordination of all operations and to improve the system's planning efficiency on the basis of developing and coordinating standardized planning solutions.

The second direction is conducting, jointly with the UkSSR AN [Academy of Sciences] Cybernetics Institute imeni V. M. Glushkov and other organizations, scientific research and experimental studies on the formation of scientific and systematic bases and the justification of planning solutions in the area of creating multilevel interactive automated processing methods for special multivariant planning as a unified, interconnected system. The basic results to come out of this study must be not only an appropriate scientific stockpile for the long term, but also specific recommendations and solutions for using ASPR and its resources in the development of integrated task complexes.

The third direction is the development of processes for the functioning of ASPR as a system that operates on a real time scale in the development of plans on the basis of improving and assimilating methods to work out indicators interactively (i. e. accomplishing the planner's work with a computer in the interactive mode). The degree of achieving these objectives will be determined to a decisive extent by resources of the developing technical base of planning calculations. Implementation of this trend depends on solving many complex systematic and industrial problems, but undoubtedly it will have great impact on improving the efficiency of ASPR and the level of its actual use in planning work. Within the framework of this trend studies also must be completed on automating the final stage in the compilation of a draft plan--providing a printout of planning forms in a computer format for drafts of annual and five-year plans in full measure.

For the long term, the development of ASPR on the basis of implementing multi-level interactive processing methods for planning must be accomplished on the base of the republic network of computer centers [RSVTs], which includes center computers that are being united by data transmission communications channels. Computers of UkSSR Gosplan GlavNIIVTs are objectively performing the role of head center in the network. During the first stage, the computers of all ministry and department OASU, as well as computers that service ASPRO, are included in the network.

Within the framework of their OASU, ministries and departments are developing their own computer networks on the basis of general principles and solutions of the RSVTs plan. So that the head link of RSVTs can perform the functions that are being placed upon it during the 12th Five-Year Plan, during the 1986-87 period it's necessary to update the computer inventory at GlavNIIVTs, install connected processors, replace all disk memory with a more reliable and large-capacity one, equip all departments of the republic's Gosplan with multiple access intelligent terminals that are connected with the central computers, and as a continuation of the computer process create a computerized industrial link for circulating and filling out outgoing (final) planning documents.

Efficient conditions for two-way (between related centers of the hierarchy) data exchange, as well as the solution of tasks of any system at the head center's computer complex, must be implemented at the RSVTs. At the network's centers data are organized and stored in the structure of appropriate ABD [automated data banks]--links of the republic distributed (during the first stage of the heterogeneous one) ABD.

It's necessary to gradually standardize flow charts for acquiring, preparing, storing and processing data at center VTs [computer centers] in accordance with the principles of unified systems-wide processing methods for the acquisition, conversion and presentation of information. It's advisable to prepare basic technical and industrial program specifications in a centralized manner.

The main thing (in an information respect) in the creation of efficient interactive processing methods for planning consists of accumulating data in the computer memory that describe purposeful (maximum and intermediate) variants of plans for the development of national economic projects and that are depicted in the language of an OKTESP [unionwide classifier of technical-economic statistical indices] and other unionwide classifiers.

The system's data base must must be built at RSVTs as the loading of an RABD [distributed automated data bank]. Data actualization in a distributed data base is accomplished in accordance with rigidly unified regulations. The redundancy (controlled) of data in the base can be permitted for reasons of economy and operational requirements (reliability, protection, preservation, and others). Contents of the data base and its use are rigorously documented through a computer method. Access to the data base at any point of it is strictly sanctioned. A unified communicative format operates on all data exchange channels.

All questions of interaction (intercomputer data exchange of ASPR with ministry and department OASU) are resolved within the framework of a unified plan. In a practical manner this means that appropriate subsystems of OASU simultaneously become external subsystems of ASPR.

A meaningful basis of system interaction is the preparation and transmission, as a consequence of regulations or an inquiry "from bottom to top," of complete variants of plans for the development of national economic projects in the required form and the different kinds of quotas, accepted standards, and requirements "from top to bottom." Ministries and departments organize the interaction of OASU with ASU of enterprises and associations within the framework of solutions of a unified ASPR plan. System interaction is organized by exchange on ML before putting RSVTs in operation.

The interaction process of UkSSR Gosplan ASPR with ASPRO is meaningfully based on the preparation and transmission via communications channels or on ML of data, which describe the variants of plans of enterprises and organizations that are under the jurisdiction of various ministries and departments located in the territory of a given region. Intercomputer interaction of ASPRO with ASU of enterprises and organizations located in the region is organized for generating variants of a comprehensive territorial plan for the region's development within the framework of solving the over-all ASPR plan.

Data received from ASPRO in UkSSR Gosplan ASPR are used for generating sections of draft national economic plans that do not have other sources of input data, as well as for checking the conformity of plan variants of ministries and departments to the requirements and limitations of regions.

It's important to provide for the development of variants of plans for developing national economic projects with regard to and in unity with measures for assimilating the achievements of science and new technology in production. A programmed cross section of variants of draft plans for the development of national economic projects is generated on the basis of data that are being presented from RASUNT [republic automated control system for national economic requirements] in ASPR at all levels of planning. Predictive and consolidated analytical data on possible tendencies and trends of scientific and technical progress in the republic's national economy are presented from RASUNT in UkSSR Gosplan ASPR at the required moments and in the necessary form during the development of draft national economic plans.

The functional basis for interaction of UkSSR ASPR with UkSSR TsSU ASGS [automated system for state statistics] is the preparation and storage in ASGS computers and the transmission in ASPR (at the republic and oblast level), via communications channels or on ML during the first stage, of data that are the base for developing draft national economic plans.

For providing effective system interaction it's necessary before the end of the 12th Five-Year Plan to complete a computerized system for state statistics (electronic automation of acquisition, arrangements in computer memory, actualization of data that objectively describe the status of national economic projects and the implementation of national economic plans by them). Intercomputer

data exchange is accomplished within the framework of coordinated plans of ASPR, RSVTs and ASGS. The relationships (including financial ones) in terms of data exchange between UkSSR ASPR and ASGS must be formalized through a special agreement. It's necessary to develop the draft system according to the over-all plan as a single whole that includes the Gosplan levels of the republic, ministry (department), oblast, associations, enterprises and organizations.

Assimilation of the system is accomplished sequentially and simultaneously in proportion to the readiness of individual links. In this regard, the process of assimilating the system at the upper level must proceed at an advanced pace. The creation of a hardworking collective of developers is an important prerequisite for successfully planning and assimilating the system. It's most advisable to perform this work in a centralized manner with the manpower of a special collective. The highest skill specialists, the labor of whom is paid for and provided with incentives in accordance with their practical contribution, must be involved in the collective without fail (temporarily or continually). The collective is being created (possibly within the framework of a systems analysis, scientific production association) attached to the head organization--UkSSR Gosplan GlavNIIVTs, which also coordinates all developments of ministries and departments in the republic that pertain to the development of UkSSR ASPR.

GVTs [main computer centers] and VTs of ministries and departments use centrally developed draft applications program packages in their computers in the course of generating variants of draft national economic plans, as well as every kind of service programs when working with drafts of a plan in a multilevel human-computer system. Variant automated development of draft national economic plans within the framework of UkSSR ASPR must result from appropriate decisions of the UkSSR Council of Ministers.

The draft's chief manager (head designer) must be appointed and provided with the appropriate rights and powers, and, in particular, his decisions and instructions (written or oral) must be mandatory for implementation by all functioning organizations.

At the present time it's a complicated matter to measure the efficiency of the described system in a precise manner quantitatively. However, from the point of view regarding the pay-off period of costs (approximately 1 year) undoubtedly it will be highly effective: the reliability and consistency of source data of planning calculations (which for the long term will be generated beginning directly with work places), a substantial improvement in balancing and coordinating planning indicators, and the possibilities of selecting the best variants of planning solutions will provide results that will become the basis for more efficient functioning of the economic system. On the scales of the republic's national economy even relatively small increases in the national product and income, which are obtained by improving the quality of the plan, exceed costs for the creation of automated processing methods for planning.

The reality and possibility of a task for creating the system being considered are confirmed by the fact that:

--in the republic certain experience has been accumulated for the automation of planning processes (the solution of planning tasks on computers). As was noted already, UkSSR Gosplan ASPR has advanced the farthest in this regard and OASU, within the structure of which individual planning tasks are solved, were created in an overwhelming majority of ministries and departments,

--a draft and measures were developed for providing first priority construction of an RSVTs and RSPD [republic data transmission system] during the 1985-87 period in which computers of UkSSR Gosplan GlavNIIVTs are the main link. The GlavNIIVTS computer complex through its own structure and capacity right now can provide for creation of the system,

--more than 20,000 algorithm specialists and programmers, out of whom nearly 2,000 have the highest skill, are working at the republic's computer subunits, and

--individual theoretical problems associated with the creation of a new multivariant, multilevel automated interactive planning system were developed by various scientific organizations. First of all, this is an outline draft of ASPR of UkSSR Gosplan and the state planning committees of union republics, and the "Displan" system. UkSSR Gosplan GlavNIIVTs, the UkSSR Academy of Sciences Cybernetics Institute, and other organizations in terms of their own experience and resources are in a position to create the system's whole scientific, systematic, and theoretical basis within a rather short time frame.

In large measure the success of creating the proposed system will depend on just how rapidly and qualitatively a number of fundamental problems will be solved, among which the following should be included first and foremost:

--manufacturing and delivering the necessary set of computer equipment, communications means, and peripheral devices with a sufficient level of reliability and repairability,

--also developing the industrial production of means (hardware and software) to protect data for restricted use from unsanctioned access at all links of industrial processes for the acquisition, transmission, processing, storage and output of data,

--creating an active OGAS [statewide automated system] plan in which the basic role of ASPR would be formulated and substantiated as the basic system during the development of problems for all kinds of support and a high priority was given to planning tasks in systems of high levels and ranks, and

--generating a theory of cyberneticizing the national economy and its most important component--the theory of efficiency of electronic systems for the acquisition and processing of multipurpose data under the conditions of its extensive integration on an ASPR base.

The creation of an interconnected (integrated) system, in the class of which the system being considered is included, to a different degree on the base of developed independent links and on the condition of their ceaseless functioning

meets in full measure the tasks set by the draft basic trends of economic and social development in the USSR during the 1986-1990 period and for the period until the year 2000 in the extensive use of automated systems for planning calculations in managing the national economy. The high potential efficiency of a system like this by improving the quality of plans being developed provides the basis for the highest skilled labor force of the republic's cyberneticists, and the required material resources were concentrated on accomplishing it. The more so as no additional resources whatsoever are required above the processes that are being directed towards the objective of electronic automation for planning and management in the national economy. The matter depends only on their being concentrated and redistributed in the proper manner in the interests of achieving the goal that was set.

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COMPUTING IN MATERIAL TECHNICAL SUPPLY CRITICIZED

Moscow MATERIALNO-TEKHNICHESKOYE SNABZHENIYE in Russian No 11, Nov 85 pp 49-53

[Article by E. Khazanovich, Director of the Computer Center of Priokskiy Main Territorial Administration Gossnab of the USSR, "Appearance of Well-Being"]

[Text] With their publication of P. Ioffe's article, "Planning and Efficiency of Computer Center Work" (No. 1, 1985), the editors initiated a very important and timely discussion.

Analysis shows that the development of an ASU [Automated Management System] for supply on a territorial level has been rather inconsistent. On the one hand, there has been definite progress. Capabilities for use of scientific decision-making methods in management have greatly increased, which has strengthened the influence of material-technical supply organs on the indicators for swings of resources, turn-over rate, transportation costs and fulfillment of delivery contracts. The supply management system is being improved structurally and functionally, and the range of automated functions is increasing.

For example, the first stage of the ASU for supply in the Priokskiy economic rayon improved the quality of decisions and the time required to make them, which had a noticeable impact on the performance of the organizations of our main territorial administration. Interest in management automation on the part of users increased due to this.

However, we must point out that one of the most important restraints on the development of ASU is the still inadequate organizational-technical level of management automation solutions. Improvement of plan-price indexes and appearance of new material-technical supply management functions sharply increases the volume of processed data and makes the demands for timely results more stringent. The limited amount of labor resources reduces growth in the number of workers engaged in management and requires selection of those technological processes and technology which would ensure significant growth in productivity among already existing management personnel.

In the years 1966-1980, capital expenditure in management automation grew more quickly than the level of automation. The creation of a network of computer centers for territorial organs led to a significant increase in the number of data processing workers. At the same time, the staffing of the management apparatus for management of territorial organs also grew, since the introduction of ASU still had little impact on the productivity of management labor and did not in any deep way affect the technology and problem-solving methods in planning and operational management of goods transfer.

These negative results were due to the inefficiency and low productivity of data processing systems. In spite of these problems, the results of the large-scale introduction of computer technology in the territorial organs of our system paid back their expense.

However, the problems, of course, remain. In this branch as a whole, the degree of management automation on the territorial level is still low. In our evaluation, this consists of these suites of tasks: demand formulation and formulation of balances and distribution plans, a little more than 13%; economic communication - 18.44%; control of deliveries - 17%; bookkeeping - 38.6%.

These generalized evaluations are formulated against the backdrop of "variegated" collection of automated functions which are characteristic for separate territorial organs. For instance, the main Leningrad territorial administration is the leader in the area of implementation of computer methods of demand formulation, inventory accounting and resource distribution, but has an extremely low level of mastery of other ASU features. In Gossnab of the Estonian SSR a scheme for automation of goods-conveying documentation and a large suite of bookkeeping problems has been operating superbly for over ten years, but labor-intensive statistical reporting 1-PS, which is simple to automate, remains manual.

The existence advanced experience on automation of various management functions is undoubtedly very valuable. However, it must be asserted that even those who are able to take advantage of this experience have not succeeded in consistently solving the problem of automation of all management functions. The exchange of this experience, which has basically remained the possession of only the developers, themselves, has proven to be clearly inadequate.

We must also note the many negative points which have lowered the potential, on the threshold of the forthcoming five-year plan, of industrial science, which is above all represented by the Scientific-Research and Design Institute of Management Systems [NIISU]. The development of ASU on the whole and of its separate elements, and even more their industrial standardization can not proceed without a design-experimental base where all design ideas can be tested before becoming standard. Our main territorial administration should become such a base for NIISU.

Ten years ago a design was made to create an ASU for supply in the Priokskiy rayon, the design of which still remains, in our view, the most comprehensive. Its potential to become the industry standard depended on the use of the same system design solutions in all the other work of the institute. Then NIISU, however, developed a parallel ASU, "Mettall", with a different systems design, thereby dissipating and weakening our forces and foregoing the potential of our territorial administration as an experimental base and the Prioksky rayon supply ASU design as a standard design for the industry.

As a result, the great investment made in this design as a main model was significantly devalued. The main territorial administration was to carry out improvements in the system by itself and the industry was long left without

verified practice and effective standard designs. When ASU "Mettall" was brought up to the necessary conditions, at large cost, it was found that its assigned functions had already been filled by individual treatments, which the computer centers of the territorial organs had to run themselves in order to load the YeS EVM [Unified Computer Series] computers. Such is the cost of strategic errors in the scientific sphere.

Now, during the switch to mini- and micro- computers the situation is changing fundamentally, and there is reason to believe that the industry will in the near future receive as an appendix to the hardware tested and introduced standard automated management designs.

The level of these designs, however, should be significantly higher than in the previous period. Real acceleration of scientific-technical progress in the upcoming five-year-plan may be achieved only with resource-conservative designs which, unfortunately, has not distinguished many previous designs. The requirement that automation of every management function require less general labor expenditure than its manual counterpart should become the standard for acceptability of every design.

This approach demands, first of all, an abrupt change in emphasis in ASU treatment to integrated automation of first-stage planning and commodity-transfer data processing and creation of information-reference systems, which carry out the most labor intensive functions of demand formulation, delivery plans, accounting and control of material-technical supply. Second, the creation of multi-computer complexes with informational, hardware and software compatibility of various types of computers is necessary. Third, the provision of automated information interconnection between territorial organs and soyuzglavsnabsbyts [All-Union Main Administrations for Supply] and with systems outside territorial supply organs is necessary. This is basically connected with the solution of complex problems.

The scientific-technical inventory in a number of cases already satisfies these requirements, but in many cases does not. Efficient technologies of integrated-automated output and processing using microcomputers for commodity-transfer documentation have already been created, but they are not hardware and software co-ordinated with technologies of data treatment on YeS EVM and SM-4. This necessitates repeated manual entry of norms-reference data into microcomputers, and of data on receipt and transfer of goods into YeS EVM and SM-4, which is necessary for the solution of a whole suite of tasks of the ASU.

One should also note that the prospects of computer systems for demand formulation using a balance method and also for the processing of available balances, control of material resource expenditure, etc., are undeniable. There are corresponding designs which carry out these functions with sufficient accuracy beginning from the point when source data have already been entered into the computer and their completeness and reliability have been assured. But the level of organization of data input, the most labor-intensive stage, is completely inadequate. We are practically ordered to quickly transcribe centrally all information on available balances which is received in the territorial organs in document form onto traditional machine media (perforated

tapes, magnetic tapes), which costs many hundreds of man hours. There is nowhere to get these resources and computer calculations of executed balances will be held up.

In contrast is the example of Gossnab of the Latvian SSR and of the Leningrad main territorial administration, where a significant portion of executed balances is presented by the enterprises themselves on computer media. But this is associated with significant organizational effort and consequently requires large expenditures which are realized within the framework of social initiative, unsupported by any kind of legal standards.

Generally, for material-technical supply ASU there is a problem of input and of assuring completeness and reliability of not merely large, but huge masses of information. It's enough to say for comparison, for example, that a giant metallurgical manufacturer with a small series type of production such as the Orlovskiy imeni Fifty-Year October steel-rolling mill, has 26,000 data items on orders per year, while the ASU for supply in the Priokskiy rayon must process no fewer than 650,000 items, that is 25 times more. Three orders of magnitude more items of information on executed balances enter into the territorial organs than into any large enterprise. It is impossible in the required time to transfer all of this data centrally onto computer media in the computer centers of territorial organs.

In our view, these organs must have the legal right to demand presentation of data on demand, orders, executed balances, 1-SP accounting, etc., on computer media or to oblige representatives of enterprises to enter the information themselves over communications channels using display technology. Work should also be done on the implementation of hardware for optical reading of information directly from the usual documents. It is not clear why this hardware remains outside the field of vision of the developers of ASU for USSR Gossnab.

This and other long-range designs for ASU information provision must be developed as part of the scientific inventory. There remains then the all possible expansion of the stock of standard designs. We do not share the skeptical attitude of certain designers and users toward these designs. For the YeS EVM, a classic example of the use of an industry-wide standard is that of the use of the Privolzhskiy main territorial administration computer center process design for accounting and analysis of aggregate supplies in the rayon based on statistical accounting 1-SN, 2-SN by the entire industry. The fact that it was tested under the complex conditions of real data processing in our main territorial administration right after its creation played a significant role in achieving its high quality.

Its design--which is verified, of proven efficiency, based on national systems of documentation, classification and coding of data and capable of functional development and joint operation with other systems--can be considered standard. It is also important that the design is systematically maintained with organized insertion of changes and improvements for the situation we are considering.

From the point of view of the above-mentioned requirements, we must also consider designs for the NIISU first stage ASU used by delivery enterprises on SM-4 computers and bookkeeping on "Iskra-555" microcomputers as standard. These designs, however, still require debugging, and the very problem of their implementation must be further defined, taking into consideration the experiences of individual users as well as those of the designer. The general changes and improvements which have been made must be incorporated into the basic design, making them accessible to all users.

The ASU Administration of Gossnab of the USSR should promote a wide introduction of standard design solutions, and consequently, acceleration of the automation process. In our view, active interaction with central administrative organs, whose activity has a great impact on data processing and decision-making on all levels of material-technical supply is required. The many changes introduced into standard designs for accounting and analysis of aggregate supplies is due not only to improvement in technology and decision-making, but is also to a large degree due to the frequent and unpredictable content changes introduced by the USSR TsSU [Central Statistical Administration] in the 1-SN and 2-SN accounting formats. Of course, absolute stability of management and data processing organization is unrealistic in a dynamically developing economy, but it is absolutely necessary that these changes be controlled and coordinated, so they do not cause a later systematic rejection by designers and users of ASU.

Further, we believe that it is necessary to prevent attempts of soyuzglavsnabsbits to depart from the standard designs, introducing unwarranted variation in the solution methods of the same problems. Our computer center carries out 1-PS statistical supply accounting for ten soyuzglavsnabsbyts, and the programs for each of them varies somehow one from the others. Are such differences in accounting data advisable? Obviously not.

Of the many problems which must be solved in order to accelerate the development of territorial ASU for supply, improvement of planning and pricing of the activity of the leaders in scientific-technical progress, the computer centers of our system, is one of the most important. A scientific classification of the expenses of data processing systems and methods for determining their quality and compensation which ensure commensurability of expenses to promote development of internal economic accountability of computer centers should be developed.

The principles employed must be the same as those that are now being developed through the large-scale economic experiment. This applies most of all to compensation for computer center expenses, which arise from their services to users.

Computer centers as production-management units are socialist enterprises. It is difficult, however, to imagine an enterprise, which after establishing the cost of its service and having fulfilled the supply contract, would be obligated to bill the customer not a fixed price, but actual expenses. The obvious economic absurdity of requiring billing only for actual computer time expenses applies only to computer centers and acts by its nature as a disincentive to scientific-technical progress.

A change from the current practice of pricing based on actual computer time expense to the use of a fixed wholesale price over the course of a year for every aspect of finished production of data processing calculated on the basis of its normative labor cost and computer cost is the foundation for economic evaluation of the computer center, which creates real interest in growth of productivity, improvement and reduction of the cost of data processing. The necessity of this has long been understood, and the Administration of the ASU of Gossnab of the USSR must display the initiative in applying economic accountability also to computer centers.

Together with this, stable wholesale prices for computer center services determined in every rayon will allow us to create industry data processing price norms. It is no secret that there is now great diversity in plan prices for the same computer tasks, a problem which will be solved immediately by the level of improvement of technology and organization. Control based on established norms will result in significant reserves of cheap data processing and therefore the capacity to expand the services offered by the computer centers of territorial organs of our system to their customers.

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COMPUTER TECHNOLOGY, ALLY OF SCIENTIFIC PRODUCTION ORGANIZATION

Moscow MATERIALNO-TEKHNICHESKOYE SNABZHENIYE in Russian No 3, Mar 86 pp 57-59

[Article by V. Andreyev, department head, and M. Korol, deputy department head at the Soyuzglavmetallurgkomplekt]

[Text] The articles "Planning and Effectiveness of Operation of Computer Center" by P. Ioffe [No 1, 1985] and "In Search of New Solutions" by R. Krinitskiy [No 7, 1985] raised pressing questions about organizing the operation of computer centers and noted a number of organizational and production flaws that have a negative influence on the effective introduction of computers with a centralized information processing system.

The editors hope that the following continuation of this discussion, which is a discussion of the interrelations between the clients and the Main Computer Center [GVTs] of the USSR Gossnab [State Supply], will supplement the dispute begun over the timely issue of introducing computer technology.

Our administration is conducting specific work on the scientific organization of labor at each workplace, the introduction of systems implementation of office work, use of mathematical management methods, and improving the relations of internal and external organizations participating in the delivery of equipment and production at ferrous metallurgy enterprises that are being built or renovated. Special attention is being paid to increasing the effectiveness of administrative labor and discovering and disseminating advanced methods of labor organization in administrative departments. A corresponding program that provides for discovery and dissemination of advanced labor organization methods in departments of the main administration and a map of the labor process in increasing the effectiveness of administrative labor has been developed and established for this purpose.

The labor process map reflects the 10 main requirements of a scientific labor organization, the fulfillment of which is directly evaluated by the departments of the main administrative board according to a number scale. The materials compiled are sent to the production committee of the trade union. The commission works with the management information system [MIS] department and scientific organization of labor [NOT] to summarize the work done and take it into account when determining the results of socialist competition.

The certification of workplaces is currently being implemented on a wide scale in industry. Organizing labor, maintaining the workplace, reducing losses of work time, using labor resources efficiently, equipping worksites with modern organization and small-scale computer technology, and even introducing minicomputers are also very urgent problems for the workers in our system. In the last few years the main administrative board has completed workplaces with organization and small-scale computer technology. This has undoubtedly improved working conditions and increased work output, but at the same time it has created a number of problems.

These include increasing workers' qualifications and having them assimilate modern comptuer technology. In this context, it is desirable to pause on the issue of organizing studies in courses at the All-Union Institute for Increasing Qualifications [VIPK]. The point is that we have directed our labor toward training staff members of supply divisions, that is, those who will use minicomputers at their workplaces. In the process, we hope that they will receive the skills necessary to work on a computer in an interactive mode. However, most of the attention of the courses is focused on the topics of programming, which is certainly important and necessary in the future, but not at the present stage. In our view, such an organization of the training process at the VIPK does not meet current requirements and needs of those being trained. At present, it is important to know how to set a task and to work on a display terminal in an interactive mode.

In the seventies, the Scientific Research Institute for Control Systems [NIISU] was involved in developing documentation for introducing MIS for soyuzglavkomplekts [unionwide administrative boards of complexes], and a permanent working group of specialists of representatives of the soyuzglavkomplekts, GVTs, and NIISU, which coordinated the total program of introducing MIS at soyuzglavkomplekts, worked in affiliation with the Administration for Supplying Equipment to Enterprises Under Construction and Renovation of the USSR Gossnab. In these years, the NIISU developed a manufacturing plan for operation in soyuzglavkomplekts on the Minsk-32 computer, which is also currently being used in main administrations when processing order documentation to accomplish the tasks of defining needs and distributing resources.

It should be noted that in the same years, many problems related to introducing MIS were solved in a more systematic and operational manner, that is, it was a coordinated operation that answered the needs of the time and produced positive results. Unfortunately, however, beginning with 1975, the NIISU was released from the specified operation, and the functions of developing documentation for introducing MIS for soyuzglavkomplekts were transferred to the GVTs of the USSR Gossnab, which is currently developing software for using the Iskra-226 computer and translating the tasks of determining needs and distributing resources from the Minsk-22 to the YeS computer. In our view, the aforementioned operations are being carried out slowly and there is no coordination among the operations being carried out.

Such a formulation of the matter may result in the software developments being unsuitable for operation in many soyuzglavkomplekts. Valuable time will pass, basic means will be wasted, and software will need to be reworked with an allowance for the specifics of the operation of the soyuzglavkomplekt.

The problem of the software and maintenance of the Iskra-226 is no less important. Many soyuzglavkomplekts have already obtained these machines, and they will be operational in the near future. However, the problem of developing unionwide classifiers according to the many types of industrial production have still not been solved.

In this context, it is necessary to create data banks of local classifiers and make them operational. This will complicate the process of introducing minicomputers in the soyuzglavkomplekts. The maintenance situation of the Iskra-226 minicomputer is also uncertain. Up to now, the soyuzglavkomplekts with these machines have not obtained operating and quality maintenance services for such computers. A computer maintenance program that functions clearly, expeditiously, and with quality has been organized in the GVTs of the USSR Gossnab. In our view, this positive work experience should be expanded to include maintenance for the Iskra-226 computer. The question of the centralized provision of soyuzglavkomplekts with necessary materials (paper, tape, floppy disks, etc.) needed for normal computer operation has not yet been answered either.

The soyuzglavkomplekts face the task of providing enterprises in the process of being constructed or renovated with all types of equipment and products in a timely manner. To a great extent, the course of the construction and making the industrial objects operational on schedule depends on processing of order documentation expeditiously and with quality, obtaining output information, and organizing a systems check on the process of the supply of equipment and products.

Introducing computers in soyuzglavkomplekts is one of the most important tasks under conditions of increased requirements for organization, accountability, and order. Currently the USSR Gossnab and its subdepartmental orgnizations have a large inventory of various computer technology, but only one YeS-1022 computer, one SM-4 computer, and 20 Iskra-226 units have been set aside for the soyuzglavkomplekts. This is very little. And if one compares how volumes of work in software development to be done at the USSR Gossnab's GVTs for the soyuzglavsnabsbyt [unionwide main administration of supply and sales organizations] and soyuzglavkomplekts are allocated, then the disproportion is far from favorable to the soyuzglavkomplekts.

This leads to the question of why such an underestimation of the needs to introduce computers into major construction happened. It would be nice to get an answer from the administrators of the GVTs of the USSR Gossnab. Today life requires engineers to manage the completion of the fundamental demolition of traditional forms of work. It is now necessary to rely on computer technology rather than on counting, telephone, and pencil. Computer technology must penetrate the entire chain of the process of making enterprises under construction or renovation complete, from receiving orders to checking the course of deliveries of equipment and products for the objects being made complete.

In our view, the time has come to establish a type SM-1420 computer complex in the Administration for Supplying Equipment to Enterprises Under Construction and Renovation of the USSR Gossnab and to locate its terminals in all soyuzglavcomplekts. With the help of this computer system, it is possible to organize transmission of complete operating and accounting information for a client or user at any time and in the necessary amount and needed lots.

The USSR Gossnab computerized processing of accounting documentation about the course of the construction and supply of equipment of especially important objects confirms the efficiency of the given proposal. The information cards produced on the computer are sent monthly along communication channels to the administration of the USSR Gossnab and are used by the soyuzglavkomplekts in their online operation. Using the information cards could have a greater effect if there were an output form for the enterprises being supplied that described the status of the order and delivery of equipment in the section of the supply divisions.

It is thought that the Administration for Supplying Equipment to Enterprises Under Construction or Renovation of the USSR Gossnab should reestablish its position regarding the introduction of MIS and NOT, significantly expand the use of computers in its operation, and exert a substantial influence on the process of introducing mathematical management methods in the soyuzglavkomplekts.

Creating automated processing for order, fund, and accounting documentation is not a simple matter, and it still has many flaws. "Barriers of skepticism," inertia in the thought of administrators, and occasionally the direct refusal to introduce mathematical management methods at workplaces still persist. Despite this, today even skeptics are admitting that experience in the operation of soyuzglavkomplekts and soyuzglavsnabsbyts confirms that the computer is not a luxury or fad but a production necessity that improves a management system significantly.

In addition, it is clear that the MIS is not a panacea from all troubles and that, in and of itself, it cannot raise the level of making an enterprise complete. The effectiveness of an MIS depends on how successfully the preliminary stage providing the serious structural and organizational changes in the system for managing the completion is carried out. Therefore, in our view, it is necessary to examine in greater detail the interrelation between the Soyuzglavmetallurgkompletk [Unionwide Main Administrative Board of the Metallurgical Complex] as a client and the GVTs of the USSR Gossnab as an executor. This is not the first year in which our administration has processed cumulative order specifications on a Minsk-32, and since 1985 it has been processed on the YeS-1022 computer that was allocated in the GVTs of the USSR Gossnab for the tasks of determining needs and allocating resources. A graph of the operation has been plotted, and an agreement between the clients and executors has been concluded for this purpose. Payment for the work done is made according to stages of the order being filled in accordance with an act of the GVTs.

All source and reference information is prepared for processing on the Minsk-32 by the client-soyuzglavkomplekt and is made according to the corroborated graph in the GVTs. All computations with a subsequent output of output information, allocation plan, ordering, delivery plan, etc., are implemented by the GVTs based on the manufacturing plan developed by the NIISU and are corrected by the GVTs itself without allowing for the specifics of the operation of the individual soyuzglavkomplekts.

The corrected manufacturing plan is not made available to the client, and, naturally, the client cannot know the details of the technological process of processing the order documentation. This leads to significant difficulties in

accomplishing a number of practical tasks in the process of introducing mathematical methods of processing order documentation.

For example, during the transition to using a Minsk-32 computer to process cumulative order specifications for cable production, it turned out that the allocation plan (VD-300) is output from the computer of the main territorial administrations section of the USSR Gossnab. Such a form is convenient and necessary in the case of transferring funds for cable production to the territorial supply organization, which is done by individual soyuzglavkomplekts, which have not switched to the operating system with the general planning organizations. For the Soyuzglavmetallurgkomplekt, Form VD-300 is required in the fondoderzhatel section [intermediate organization supplying the materials], that is, without subdivision into the main territorial administrations because funds for cable production are not transferred to the territorial supply organizations, but a group job authorization for the fondoderzhatel is obtained from the Soyuzglavkabel, and it is allocated through the enterprises based on their needs for supplies produced by the USSR Gossnab. The Soyuzglavmetallurgkomplekt has been working on this problem for an entire year but has still not been able to solve it successfully.

An "NOT-snab" [scientific organization of labor-supply] institute is functioning in our system. Many of our organizations have used the direct results of its operation in the area of developing and producing office mechanization facilities to equip workplaces. New questions about organizing labor to improve the technology for originating and processing order and funding documentation in sections of the main administration and the interrelations of general supply organizations with planning institutes supplying enterprises, soyuzglavsnabsbyts, ministries, and departments are being brought to the forefront.

The specified questions have a great significance in the everyday life of our collective, and the expeditiousness and quality of providing equipment and productions to objects being made complete depend on their formulation and on organization of execution. However, we are not receiving the necessary information, and finding it is not feasible. All this has a direct relation to the scientific organization of labor, and the "NOT-snab" institute should probably include such tasks in its thematic plan and institute the corresponding scientific developments.

It is time to cast aside the safe mask of disorganization and unaccountability, conservatism and inertia. Knowing this, the collective of our administration is conducting a persistent search for new, progressive approaches to solving the problems facing us. We are applying all our strength to the successful fulfillment of the plan to make the equipment and products of enterprises under construction or renovation complete in every detail by increasing the intensity of labor, using computer technology, and signifcantly improving the organization of labor at every workplace.

12794
CSO 1863/307

COMPUTERS IN ARCHITECTURE DISCUSSED

Moscow PRAVDA in Russian 28 Dec 85 p 2

[Article by PRAVDA correspondent O. Gusev, Kiev: "The Computer as a Partner of Architecture"]

[Text] It has turned out that the papertape of the computer and the high-quality drawing paper of the architect have "become friendly" to all of us essentially unnoticed, although the fruits of this useful symbiosis are now rather clear, while the effectiveness of combining the forces of two muses--architectural and cybernetic--exceeds even the most daring predictions each year. A visit to the Kiev Zonal Scientific Research and Planning Institute for Standard and Experimental Design of Dwelling and Public Buildings convinces one of this.

The country's first Department of Architectural-Construction Cybernetics was recently created here. A unified data bank for planning and design documentation of hundreds of standard designs published in the country has been formed. The volumes of these data and this means the level of automation of design work are growing from day to day.

"The annual dynamics of their growth is 3-4 percent," the deputy director of the institute L. Dmitriyev makes clear.

The display classroom is adjacent to an enormous hall. It contains computers that execute 1.5-2 million operations per second. Architect D. Miroshnichenko "converses" with the computer in the customary rhythm already established for him. The topic is how one of the housing regions of Guryev in Kazakhstan should look if the ornaments of the facade, maintained in the national style, are decorated.

Miroshnichenko "ignites" the green lines of the drawing by a light touch of a light pen on the display screen. We see how one panel, right before our eyes, begins to sparkle with figured ornaments, while another begins to sparkle with textured ornaments. Another touch and the building is completed. Still of course theoretically, the computer recreates the best fragment of the facing.

And designer B. Moroz is finishing the installation layouts of the building frame during this time. The computer displays the optimal versions of construction materials to the interlocutor within an instant and refines the expenses

for metal, cement and other components of the structure designed during these "electronic" conversations.

No longer streams, but entire rivers of information, "saturated" with conserved tons and rubles, are flowing to the workstation, where operator N. Slyusar is working. He has been working here not quite 1 year and, because of computer-aided design, can now solve twice as many tasks as before. Each list of specifications to the drawing of an installation layout, given to her from the computer, is high-quality, so to speak, instructions to the engineer, technician and even to the worker of how and in which sequence to assemble one or another elements of the building, of which type of structural member to use and which brand of concrete to use.

The engineers of the Department of Architectural-Construction Cybernetics, present during the conversation, turn attention to the fact that even quite recently, all these rather voluminous data were issued in a heap without precise addressing. And sometimes the client almost drowned in cumbersome figures. The necessary data are now issued to a specific user. The annual saving of expenditures due to use of computer-aided design (SAPR) of several construction objects comprises approximately 5.5 million rubles.

One can interject: you cannot lay the foundation with only figures, even the most hopeful ones. Variants of methods are also necessary which reduce these calculations to the lowest common denominator. The bank, whose recommendations become their own type of "gold reserve" to stimulate a universal scientific and technical search of all participants of the construction conveyor, also helps to "filter" them out.

And the result is the computer helps to conserve approximately 10 percent of reinforcement alone used in wall panels and other structures. The quality of designs increases simultaneously, the labor productivity of engineers increases and in the final analysis the significance of the objects is improved. The computer-aided design system operating at the institute has this year alone made it possible to conserve more than 3,500 tons of metal and more than 7,000 tons of cement

"It is no accident," says the director of the institute A. Zavarov, "that it was planned to design and develop the pilot model of the SAPR in our collective for the institutes of Gosgrazhdanstroy [not further identified]. Besides the bank of design data, this complex will be equipped beginning next year with a central computer system. A network of terminal computer complexes--so-called automated workstations--is being developed at the institutes of the sector. It will provide output of documents transmitted from the central electronic "brain" and will also process the designs in the early stages.

A powerful experimental base has been created at the institute to obtain a return as quickly as possible from automation of design matters. It is located at Darnitsa on the left bank of the Dnepr River. There are more than 10 shops here. Among them are those which produce windows, doors and stained-glass panels that improve the face of buildings, after a number of operations, directly from the aluminum pig. There are also shops which fabricate nonstandard reinforced concrete structures, needed in erection of the experimental structures

developed by the institute. It is interesting that many of their designs have been created for the first time in the country and are now undergoing an experimental check, for example, at the Kiev housing tract Teremki-1.

"It is this approach to implement the designs within the shortest possible periods through our experimental base," says the chief engineer of the institute A. Kasilov, "which permits us to reduce the time for analysis of the usefulness of a proposed innovation in one-half or one-fourth of the time. Interaction of the sections of the construction conveyor from the idea to the finished building is also best worked out in parallel."

Of course, not every specialist is able to "draw" architectural ideas from an electronic bank. Therefore, by inviting specialists to familiarize themselves as much as possible with the work experience of KievZNIIEP [Kiev Zonal Scientific Research and Planning Institute of Standard and Experimental Design], it is felt that the managers of the sector should propose methods of duplicating the innovations on a timely basis. The Kiev architects are suggesting that it be taken more rapidly. No one will be the loser: the doors of the bank of our designs are open wide both for depositors and for clients.

6521
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ELECTRONIC BARRIER TO LOSSES

Tallinn SOVETSKAYA ESTONIYA in Russian 12 Feb 86 p 1

[Article by A. Sayankin]

[Text] New technology for dispensing petroleum products to customers has been installed for the first time at the eighth and eleventh filling stations in Tallin. It has completely automated the fueling of the state transport system. Microcomputers manage all operations at the two filling stations. When filling a tank with gas, a driver uses a magnetic credit card. The calculating device of the electronic filling stations attendant makes it possible to obtain fuel at any pump in the filling stations without engaging an operator.

The suprise begins as soon as we cross the threshold. We approach a filling station building. Not a soul is there. The small sign over the attendant's window announces that there is a dinner break at the station. Around the pumps, several employees of the Zhiguley patiently await the proprietor. But then a black Volga taxies up to a mushroomlike device with a bright sign "ASRO". The driver gets out, takes a plastic badge from his pocket, puts it into a special slot in the panel of an electronic machine, and selects a code and pump number. The entire operation hardly takes more than a minute.

"You don't say anything," smiles Teet Reynaru, "It is very convenient to refuel here." And how much time and nerves this system saves. It is well disposed toward beginners. It "forgives" a driver's errors up to 10 times and only then "arrests" his credit card.

Shortly thereafter, the proprietors of the Zhiguley, who have been dawdling around the pumps, approach. However, they do not manage without contact with a real live attendant. One-ruble notes flash and small change rings..."

"Certainly," agrees Valeriy Khachaturov, who is the director of the computer center of the Estonian SSR Gosnefteprodukt [State Petroleum Production], "the procedure for filling private vehicles is not as effective, although it is also partially automated. Look at the attendant sitting behind an electronic cash register. By pressing a key, he switches on the pump needed by the driver and prints out a check showing how many liters were dispensed. If the client does not take as many liters as he ordered, he has the right to demand credit from the attendant for the undelivered fuel."

But electronics does not only control the machines. In a matter of seconds it can determine how much petroleum product is contained in the tanks and how much

water and it can give a readout of the operation of a station for any time interval and can even check the activity of an attendant based on a computer report.

"The new technology for refueling state and private transport complete eliminates the "leakage" of fuel to the side," continues V. Khaturov. A minicomputer registers any attempts by an operator-attendant to snatch a large sum of fuel for himself online on magnetic tape. In turn, the owners of private vehicles must be more principled. When they see that they did not receive the right amount of gas in their tank, they must go up to the attendent's window and demand credit for the undelivered liters."

Thus, the main "plus" of the new technology is that it ensures the safety of petroleum products and increases the effectiveness of using motor transport.

The large operation, for which specialists at the Computer Center [VTs] of the Estonian SSR Goskomneftprodukt [State Committee for Petroluem Production] have taken two years, is still not finished. Only half of the path has been crossed, but the most difficult half. The ultimate goal of the complex program is to have all the filling stations in Tallin completely embrace credit technology and to erect a reliable electronic shelter for expensive fuel.

12794
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SYSTEMS TO AUTOMATE PLANNING AND DESIGN

Moscow EKONOMICHESKAYA GAZETA in Russian No 14, Mar 86 p 6

[Eighth installment in an article by Professor V.A. Myasnikov, head of the Main Administration of Computer Technology and Control Systems of the State Committee of the USSR Council of Ministers in Science and Technology under the "Computer Literacy School" rubric.]

[Text] In this country there are more than 3,000 independent planning and design organizations and approximately 30,000 planning, design, and production subdivisions at enterprises. The majority of this army of planners, designers, and process engineers continues to use Kuhlman drafting unit-type sketching boards and elementary computational means, primitive clerical aids, and a set of reference and archival materials.

The widespread use of mathematical methods and modern computer technology in planning institutes and design bureaus has been called for to sharply reduce the times and increase the quality of planning and design operations. The experience of using computers shows that both the so-called routine operations (scientific and engineering computations, compilation of appraisals, output of sketches, specifications, and normative documents) and the design of the most complex objects lend themselves to automation.

As is well-known, the design process includes an alternation of intellectual and creative and formal types of activities on the part of the designer. Formal operations occupy about 50 percent of the engineer's time and lend themselves to automation rather easily. Using mathematical methods and computers makes it possible to expand a person's creative capabilities. Computers make it possible to compute and analyze many variations of solutions to a planning and design problem and to select the optimal solution in a short time.

In order to use a computer effectively in the planning process, it is necessary to develop a mathematical model of the planning object. It reflects the essential properties and characteristics of the object in the form of mathematical relations. Such models make it possible to determine a number of working engineering characteristics of an object without labor-intensive manufacture and testing of a test specimen.

Computer-aided design [CAD] systems are being created to accomplish an entire complex of planning and design tasks at organizations and enterprises.

CAD is an organizational and engineering system with an automation complex consisting of a set of methodological, software, hardware, informational, and organizational support.

The methodological support includes theory, methods, mathematical models, algorithms, norms, standards, and other data. The most important and most labor-intensive operation is that of creating software to accomplish planning and design tasks on highly effective CAD hardware.

Complexes of CAD hardware may include computers and peripherals with different capabilities and functions. Thus, large planning and design organizations are equipped with high-power computers that have a productivity in the tens and hundreds of millions of operations in sections, a main memory of several millions of bytes, and peripheral memory devices with tens and hundreds of thousands of megabytes.

These computers may be connected with automated workstations [ARM] for a designer or planner. ARMs are created with the help of computers having a lesser productivity (0.5 to 2 millions of operations per second) that are equipped with peripheral devices for input and output of graphic and text information. Design and configuration tasks that do not require highly specialized complex optimization computations may be accomplished at an ARM in an offline mode.

Informational support, which contains data on standard solutions, reference data on original equipment manufacturer [OEM] products and materials, and specifications and descriptions of analogous products of foreign firms, etc., is contained in memory (on magnetic tape or magnetic disks).

Organizational support contains orders, instructions, staff schedules and other administrative documentation that provide for the interaction of subdivisions during the creation and operation of CAD.

Using CAD makes it possible to shorten the execution of computational operations tenfold and to shorten the output time of specifications for new products severalfold. CAD makes it possible to make any changes in planning documentation, including radical revision, in all stages both simply and quickly. This is practically impossible with traditional methods, especially in the concluding stages.

Our next session will be devoted to the work of the designer (planner) who uses CAD.

12794
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COMPUTER EDUCATION IN SOVIET SCHOOLS

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 19 Feb 86 p 3

[Interview of mathematician Academician A. Aleksandrov by A. Yakovlev: "The Student and Computers"]

[Text] The first half of the school year has been completed. One can summarize the results and make specific conclusions of how the new course "Fundamentals of Informatics and Computer Technology," introduced this academic year, survived in the school. How are the students adapting to the new subject? How is the teacher managing it? What problems have occurred with regard to the course? The prominent mathematician Academician A. Aleksandrov and our correspondent A. Yakovlev discuss this.

[Question] Aleksandr Danilovich, I would like to hear your opinion about the significance of the course "Fundamentals of Informatics and Computer Technology."

[Answer] One can hardly find a person who doubts the need and timeliness of the new school subject.

It is a different question as to what degree our schools were ready for this. Insofar as I know, matters are far from identical everywhere. Is this not so?

[Question] The students from school 17 of Voronezh long before introduction of the new course learned how to compile programs for computing the values of simple functions in optimal programming exercises and to implement them on BZ-34 programmable microcalculators. The school had already made them available to the students in sufficient quantities for the entire class to work. There will hardly be any difficulties in this school with the new subject.

[Answer] I heard about this school. Incidentally, it is not the only one. The country's first school computer center was recently created at Novosibirsk.

Excellent display halls have been equipped at Leningrad through the efforts of students. However, it should be recognized that these examples are not yet the rule but, you must concur, exceptions.

[Question] Alas, this is true. I was recently on a business trip to Penza. School No. 18 in this city has an excellently equipped display classroom. The

secret is simple: it has a patron computerized "to the teeth"--the Penza Computer Plant, which is directly interested in how personnel are trained for the plant.

[Answer] You note that we are still talking only about large industrial centers. And what are schools to do in small cities, of which we have multitudes.

[Question] I can give a list of how things are going in Moscow Oblast rather than somewhere in the interior. The new course "Fundamentals of Informatics and Computer Technology" is being taught at 917 schools. There are approximately 4,000 different types of microcalculators in them and 15 display classrooms with 12-15 seats each have been equipped. But this is just a drop in the ocean.

[Answer] I have a somewhat different opinion. I do not feel at all that each school needs the scale with which the new subject is taught in some Novosibirsk schools or in the same Penza school, where patrons are training personnel for themselves. The student, if he is not planning to become a professional in this field, does not require such extensive study of the subject. It is one thing to acquire skills in driving a car, which can be useful to everyone in life, and it is quite a different thing to learn how to pilot a jet aircraft, which may be useful only to one of hundreds of thousands. The same thing is true of computers, which will become necessary in the near future to everyone, but only to a specific degree. The nonspecialist is quite content with the most general information about it, while everyone should have a good concept of the capabilities of using computers within one's occupation and in daily life. To know how to think logically, to formulate one's idea clearly and simply, to pose problems to the computer precisely and specifically--this is what the students of the 9th and 10th grades need to study without exception. He who selects the occupation of programmer or operator will obtain special knowledge later.

[Question] There are hotheads who assume that a new course has been introduced, programs have been compiled, a textbook is available and lessons are being given--what else is needed.

[Answer] The hotheads should cool off. It is too early to put together victorious celebrations: both the lessons in the new subject are far from being conducted effectively everywhere and the successfully developed textbook requires considerable revision. With regard to the instructors who teach the new subject, many of them have seen computers only secondhand and do not know how to deal with them. Perhaps, of all the problems, one should separate out the following: equipping the schools with sufficient quantities of the necessary hardware and training qualified instructors.

[Question] Let us dwell on them in reverse order. The main mass of teachers took a 1-week course in the spring on theory and were involved in practice another week during the summer--they drew flowcharts of the simplest programs and exactly they drew them--they were still unable to study independently and solve a simple task of an academic nature on the computer according to a previously dictated program. The institutes for improving the qualifications of teachers are of course doing a lot. For example, familiarization lecture-

seminars, at which so-called "anticipatory" surveys of lessons for the following month are conducted, have been organized, for example, at the Moscow Oblast Institute. This makes it possible to some degree to liberate the teacher of the fear of the subject but, of course, it does not solve the problem.

[Answer] To solve the problem, serious, specific teaching of pedagogues, perhaps in several phases, rather than rush courses and seminars (although they do play a specific role at the given stage) are needed. Insofar as I know, approximately 60,000 students accepted during this academic year at 55 pedagogical institutes in the country will acquire a second specialty--teaching the fundamentals of informatics and computer technology. Many students who will graduate in 1988 will also receive fundamental training in this specialty. But all this is a future matter. Urgent measures--strictly thought out and realistic--are needed now. The main thing is that study and dissemination of each grain of useful experience must be organized. And of course they must not behave as was done at Barnaul. A Minsk-22, which was taken out of production almost 20 years ago and is no longer used anywhere, was delivered to one of the schools. And what good is it to one who will travel in a Zhiguli automobile to study the working principle of a Stephenson steam engine? I am told that there is generally no computer hardware at all, even the simplest microcalculators, in most schools. They have only one method: "blackboard and chalk."

[Question] But the "nonmachine" version of teaching is envisioned by the school program as a compulsory temporary measure. Equipping most schools with the necessary hardware is still far in the future. I recall what the project manager for creating a school course on informatics and computer technology Academician A. P. Yershov said about this: "It would be wonderful if we could create a single computer office in each region of the country during the next five-year plan. This is approximately 5,000 schools--those into which one can matriculate without purchasing an airplane ticket." This means that one must cope sometimes with small-scale informatics.

[Answer] Any expectation is brightened when you know for what you are hoping and must wait for. Certainty is needed here if you want a rigid plan for production of computer hardware and complete clarity is required as to who, when, what and how much to produce. We have sufficient capabilities for beginning to manufacture this hardware on a uniform basis in sufficient quantities, but they remain unrealistic without skillful organization of matters.

To tell you the truth, I am not a proponent of the "nonmachine" version and of chalkboard informatics. I accept it, as they say, grudgingly and only as a really compulsory measure. However, in accepting it, I realize that the absence of computers in the schools will not only make it difficult, but may distort teaching, reducing training to conversations and of creating a persistent psychological rejection in the students instead of skills and interest in the new subject. To avoid this, the lessons must be constructed in a well-planned, attractive and intelligible manner, using any capability of demonstration to supplement the lecture in this case. A training movie (and perhaps an entire series of films) would be very useful in this case. They would fill in to some extent the gaps of the "nonmachine" version, would help the teacher, would make the lessons more lively and would facilitate understanding. Incidentally, the teaching screen would not be superfluous even if computers were available.

The popular literature for both students and teachers should be rushed. The pedagogue also needs a special methodical journal, similar to let us say, MATEMATIKA V SHKOLE [Mathematics in the School]. I am no longer talking about publication of a current universally well-thought out school textbook instead of the existing textbook, which is only the first part of the temporary manual compiled without an experimental check.

Introduction of the course "Fundamentals of Informatics and Computer Technology" in the schools is the duty of time, a brave creative search and any search and any innovation, as is known, is not devoid of errors. But do we not learn from our mistakes? This means that one must not be afraid of mistakes and it is much more important not to mask them and to learn a lesson from the first lessons.

6521
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SUPPLY OF COMPUTERS TO BE HASTENED TO SCHOOLS

Frunze SOVETSKAYA KIRGIZIYA in Russian 2 Aug 85 p 3

[Article by E. Taranova, "Electronic Universal Education: Learning to Interact with Computers"]

[Text] The electronics which will be in operation in the 21st century is being born before our eyes. Electronic computers long ago went beyond being just calculating devices and have increasingly become an intellectual tool of modern man. The application of computers in the national economy opens up hitherto unenvisioned horizons: the control of industrial processes, the real-time output of diverse information which simply cannot be stored in the human brain, as well as design work, drawing, making animated cartoons, and much more can be turned over to the computer!

But all of these electronic capabilities may be realized given one condition: the training of the most extensive group of people in interacting with computers. The following is stated in the Main Trends in School Reform, "Equip students with the knowledge and skills of using modern computers and provide for extensive application of computers in the teaching process." Ways of accomplishing this at Frunze School No. 61 imeni Kurchatov are discussed by the director of studies, Ye.B. Yakir.

"To use the expression of the President of the USSR Academy of Sciences, A.P. Aleksandrov, the work of electronic universal education in its scope and complexity is reminiscent of the battle to eliminate illiteracy following the revolution. Yes, this is a requirement of economics, a necessary condition for the modern general educational training of young people. It cannot be allowed that schools handle this problem individually. The introduction of computer hardware into the school teaching process in impossible without the active participation of the higher educational institutes, enterprises and ministries, which must show a party-like concern for this important national matter of state."

"The cooperation Frunze Polytechnical Institute has shown us deserves attention in this regard. As early as 1979, a "Young Programmer" circle was organized in the school; it was headed up by the leading teachers of the institute. It also became the foundation for the subsequent teaching of information science, programming and computer technology. The students acquire practical

skills in working with modern computers while performing tasks in the computer training center of Frunze Polytechnical Institute. The children have the capability of independently working through all the steps in the development of an algorithm, programming as well as debugging and solving problems on the computer."

"The party committee and rectorate of the higher educational institute are showing great interest in the students. With the help of the institute, we have equipped ourselves with a department of information science and computer technology, which is outfitted with the "Iskra" microcomputers, various calculators, electronic circuits and a control console. But we feel that even this is still inadequate. The setting up of a display class is now underway. So that by the new school year, our students will receive an entire computer complex.

The creation of such an arsenal of hardware is explainable - our school is a specialized, mathematical one. As far as ordinary schools are concerned, where starting this fall in the senior classes teaching of the fundamentals of information science and computer technology is also being introduced, this teaching is initially provided basically without using computers. But this, in the opinion of the authorities, is nonetheless like teaching one to ride a bicycle without a bicycle. Time is needed in order to supply the school with the necessary hardware. This period can be considerably curtailed in our opinion.

It is well known that computer hardware and microprocessors are taken to equip enterprises and organizations of many departments in the republic. The computer centers operate in Gosplan, the Kirgiz Main Power Administration and various ministries. Electronic innovations are being incorporated in the practical operation of plants at a fast pace. Why could not the specialists of these numerous computer centers become true assistants and friends of the schools? This would also be farsighted. For having obtained solid skills in working with computers, graduates will be readily incorporated in modern production operations. After a year or so, others could be added to the staffs of those same enterprises that helped them out. Let's say that our youngsters receive a programmer's certificate along with their intermediate education diploma. The level of their training is such that they are capable of using the knowledge obtained directly in practical work.

The active leadership of adults in electronic universal education is only one side of the matter. Another aspect is no less important: a deep understanding of the necessity of mastering the latest computer technology by the students themselves. And here we cannot be limited to just the study of types of computers and their components. This will truly be "riding without a bicycle". One must provide the possibility for teenagers to solve specific technical problems, making the lessons close to those of modern production so that they have the capability of completely seeing the range of computer applications, understand the machine and learn how to interact with it.

This, it is thought, should be the creative approach to the implementation of the important school reform proposal.

8225
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APPROACHES TO COMPUTER EDUCATION IN SCHOOLS DISCUSSED

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 20 Dec 85 p 3

[Article by N. Sadovskaya, scientific staff member of Novosibirsk State University and teacher at School No. 130, "Do Not Wait, But Act. How to Help the School with Universal Computer Education"]

[Text] What computers are best suited to schools? This question is the one most often asked me by teaching colleagues. Their concern is understandable: universal computer education, called for by the latest party and state resolutions, must be implemented in a specific manner. Where do we start?

There are now two approaches to the introduction of computer hardware into the teaching process. The first is via the organization of individual work stations for students using personal computers. This is what is called the school-desk computer. The second approach is the interfacing of the school to a computer with the rights of a subscriber. That is, the approach of creating a terminal class, working through ordinary telephone lines to the computers of an enterprise, scientific research institute or higher educational institution.

Without negating the first approach, I think that the second is preferable. Primarily because it entails close linkage and serious support of the school on the part of the national economy. This assistance, as has already been confirmed at the very outset of this work by the first chairman of the Siberian department of the USSR Academy of Sciences, academician M. Lavrentyev, is quite necessary. It is difficult for the ordinary school independently to set up specialized computer education. It does as not yet have either the specialists, the equipment or the methodology for such work. However, these acknowledgements are not a cause for pessimism and procrastination. One must proceed decisively. With the same drive and certainty of the necessity of each step with which the elimination of ordinary illiteracy was undertaken in its time. The time now is no less significant. The elimination of computer illiteracy in society is a question of reinforcing the foundations of our economy, providing a catalyst for the vital activity of the entire nation. It is rightful that this is noted in the draft of the Major Trends in the Development of the National Economy in a separate line: "More actively introduce information science and electronic equipment into the teaching process."

But this work is so extensive and unfamiliar to the teaching profession that the desire to wait it out is only natural. Let someone try it and then we will begin. We will make fewer errors. No, we the teachers who have already been working and are working in this area feel differently. One must begin on the most active and broadest possible scale. This is why in my school, during 20 years of universal computer education development, we have passed through all of the stages. From computerless teaching of programming in optional courses with irregular trips to the computers of the base support enterprise all the way to teaching in a direct computer interaction mode directly from the school classroom.

It is specifically this latter variant that has proved to give the best results. It was also demonstrated at the USSR Exhibition of National Economic Achievements in the "National Education" pavilion. It looks like this: we make a telephone connection to Novosibirsk and interface with the computer of the main operational computer center of the Siberian Department of the USSR Academy of Sciences. There are 3,000 kilometers between us. This is a thousand times more than between our school and the computer center. But the essence of the approach is not changed by this.

At the request of colleagues - visitors to the pavilion, we call up on the terminal display any of 400 programs in our teaching bank in any sequence. They differ in terms of their area of knowledge, pedagogical direction and age for which they are intended. We have, by the way, programs for first graders. They learn to master the display console beautifully.

In what way is direct interaction with a computer through a multiple access network convenient for such a subscriber as a school?

We begin with the fact that the lesson starts at a time convenient for the school. The computers of computer centers rarely fail. While this is another story for personal computers. Who will fix them? The school does not have the means to support a staff of engineers and electronic technicians. Should one region, for example, set up the service for all personal computers of the schools? This is also doubtful. There is no hope that the personal computers in the schools will be uniform.

The second thing: a change takes place in computer technologies no less often than once every two to three years. This is a natural and a necessary process. The school, with its conservatism, both psychological and financial, cannot chase after computer variants. This means, the approach of establishing one's own computers can lead rather quickly to a gap between the school training and the future professional activity of the student. It is absurd to teach children the technology of the past. For this reason, the tendency of some basic enterprises to wave off school concerns and to turn obsolete electronic equipment over to the schools is harmful. The most advanced computer equipment from the viewpoint of tomorrow should be available in the school. And as yet, one can apparently only obtain it by becoming the subscriber of a multiple access computer network.

This approach also promises a pedagogical advantage. For example, personal computers entail the necessity of the duplication of teaching courses and programs in millions of copies. This is an expensive business. These same programs can be forwarded to the terminals of any subscribers though in a multiple access network. By the way, regardless of its location. This means that the most advanced pedagogical information can reach even the most remote school. This is the way to eliminate the gap between the prestigious and peripheral schools.

Moreover, a network combining computers having large resources is capable of taking on the functions of a programmer, avoiding the necessity of having the teacher of the subject professionally master programming. The issue here is that of specialized automated teaching systems. The software of our computer, for example, makes it possible to automate the compilation of multivariant jobs. The jobs are generated for each student and at each particular point in time individually by a random number generator. One can even conduct the teaching at the individual pace of the child. This also is done automatically. The teacher only enters the average statistical time for the execution of the jobs in the program. The teaching program analyzes the working speed of the student and either increases the time allowed for an answer if the student is one of the slow ones, or decreases the time if the student is among the sharp students.

All of this does not isolate the teacher from the student. On the contrary: the individual pace of taking the course forces the teacher to work as a multiple work station operator. In the usual class, the teacher simultaneously handles two to three standard subgroups of students. In the terminal class, he handles tens of them. One has gone far along in the course, many lessons ahead. Another has lagged behind while a third has started to play with the machine in general . . . questions rain down on the teacher like hail. Moreover, the different questions also require an answer at the speed of a . . . computer. For the student is tuned to the same rhythmic frequency as the computer and it irritates him if the teacher thinks worse than the computer or longer. It is difficult for the teacher, but nonetheless, the yield from such teaching is much higher in the final analysis.

The remote teaching regimen using a multiple access network clearly shows economic and pedagogical efficiency as compared to other forms of computer teaching. In our opinion, close ties to base and supervisory organizations are our hope and support.

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ROLE OF COMPUTERS IN SCHOOLS SHOWN AT EXHIBITION

Moscow GOLOS RODINY in Russian No 51, Dec 85 p 5

[Article by V. Ryndin, "Trip to the USSR Exhibition of National Economic Achievements: A Schoolboy at the Computer Console"]

[Text] Igor Nikolayev, a student at one of the Moscow schools, became the director of a large vegetable farm. He sits at the console of a personal microcomputer and decides how many hectares of beets, cabbage and carrots to plant, how many tractors and other agricultural equipment to buy, and which project plans to use for the construction of residential housing and farm buildings.

His classmates sit alongside Igor; they have become bookkeepers, agronomists and builders, and they help him in answering the questions appearing on the display screen.

After an hour and a half, the computer adds up the totals for the agricultural year. Rather depressing estimates, it must be said, appear on the screen. But Igor and his friends are not upset: for this is fortunately only a game.

In the "National Education" pavilion at the USSR Exhibition of National Economic Achievements, where it took place, the schoolchildren and all who wish can test their own capabilities by means of computers. The "Computer Technology in National Education" exhibition has opened here now.

As is well known, a new academic subject has been introduced in all Soviet schools starting in September of 1985: "Fundamentals of information science and electronic computer technology". The students study the design of computers, work out the course for the solution of problems on the displays and learn how to write programs.

I became acquainted at the exhibition with a staff member of the Scientific Research Institute for school equipment and instructional hardware, Nikolay Petrovich Sukichev, who provided specialist advice to visitors and demonstrated the operation of these various computers.

"The introduction of the new academic subject," said Nikolay Petrovich, "was due to the fact that computer hardware has come to play an important part in the solution of the most important economic and technical problems. By turning the mechanical routine work over to the computer, man frees himself for the more intense creative activity."

According to the calculations of scientists, the amount of just scientific and technical information doubles every five years. Only the computer can assist in handling such an avalanche and in efficiently processing and utilizing the new information. This is why knowledge of the fundamentals of information science and computer technology is now so essential to a specialist in any sector of the economy.

My conversational partner familiarized me with the various school computers. The "Agat" personal computer is worthy of attention. It is designed for people who do not have special training. By connecting this computer to a TV set, one can perform scientific and engineering calculations and even convert the screen into a game board. The "Agat" is already being used in our nation's schools.

Visitors to the hardware and software system of teaching tools based on the "Elektronika-60" microcomputer stand around for a long time. It was developed at vocational technical school No. 8 in the city of Ryazan.

It is interesting that the vocational technical school did not have its own computer, and then the students and teachers decided to build one themselves. There were many difficulties but scientists of Ryazan Radio Engineering Institute came to their assistance and the matter turned out well.

Teaching programs have been developed for the system to accelerate the mastery of microcomputers and for the solution of mathematics and physics problems.

The students have so confidently mastered the skills of working with microcomputers that some industrial enterprises in Ryazan are already turning to the school with the most insistent production requests.

Of course, it is difficult to master computer technology by one's own efforts in an intermediate school without the assistance of institutes and enterprises. And the school is receiving this assistance. One of the exhibits tells about this. The students and teachers at the Moscow Engineering Physics Institute are supervising one of the schools and have developed applied teaching programs for various classes. The staff of another higher educational institute, the Moscow Institute of Electronic Engineering, has assumed the supervision of two schools in the city of Zelenograd. With the help of the institute, the students have mastered the technique of working with an interactive computer system and have written teaching programs for the Russian and English languages as well as physics. Incidentally, the programs for the various games with which we started our discussion were also developed here. As practice has shown, they allow students to much more rapidly master the skills of working with computers.

Electronic technology has come to school and is assisting the students in better assimilating knowledge, teaches independence of thought and also educates them to take the initiative in work.

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PERSONAL COMPUTER USE IN BULGARIAN SCHOOLS

Moscow KOMSOMOLSKAYA PRAVDA in Russian 14 Jan 86 p 3

[Article by G. Chernakova, "The Computer Comes to Class; the Experience of Friends"]

[Text] A small green dot lights up on the screen and slowly slides upward, leaving a lettered track behind it: "Hello! Wouldn't you like to have a chat?" This is how the "Pravets 8M" personal computer greeted Muscovites; this computer is one of the numerous models that Bulgarian specialists brought to the capital, to the Technical Center for Machine Building of the Bulgarian People's Republic, for the computer exhibition.

We did not accidentally choose this computer to become familiar with. It is one of those computers that has become an irreplaceable assistant for the work of a teacher in Bulgaria.

The "Computerization Plan" is the term in the Bulgarian People's Republic for the Program of Activity for Teaching the Youth of the Republic Electronic Computer Technology, which was adopted in 1984 at the plenum of the Dimitrov Young Communist League Central Committee. This is a document designed for the long term, but the initial results of its implementation can already be seen. In the course of the so-called "preparatory period" (it was completed at the end of 1985), Bulgarian schools received more than 8,000 computers. The "Kompyuter" clubs have been created in many Bulgarian cities and computer centers operating between schools are in service. In the technical schools and higher educational institutions related to electronics, special consulting rooms have been opened up that are equipped with computers, which are made available to students doing scientific and technical creative work. In the technical school for electronics in the capital, headed up by specialists from the Bulgarian Academy of Sciences, the first teaching laboratory has begun operation, where various programs are developed for the needs of public education. Many of them are already being used in the schools.

"Would you like to become a student for a moment?", asked Khristo Boshnyashki, the representative of the Instrument Making Plant in the city of Pravets, who came to the Moscow exhibition, "Have a seat." Khristo presses one of the keys and the following legend appears on the screen: "Geography. 7th grade. Topic: the earth - a planet of the solar system."

Our trip through the world of the planets and stars takes about a half an hour. The computer shows, draws, explains and asks . . . "And it even prompts," adds Khristo.

"What!? Is this really permitted in the schools?"

"Of course not. Our computer does not give the student the answers on a plate, but rather directs the course of his thinking. And this is quite a different matter. Here, see for yourself . . ."

"What do you think, do other civilizations exist other than that on earth?" unexpectly asks the "Pravets".

I am at a loss. The computer comes to my aid:

"The constellation Coma Berenices is located at a distance of 360 million light years from earth. It consists of several hundred trillion stars. Cold heavenly bodies orbit around them just as in our solar system. And now try to answer the question."

"Well, now you see: there is prompting and then there is prompting," says Khristo instructively.

"Does it turn out that the teacher is not needed at all? The computer does everything itself, just press the keys . . ."

"No, you are wrong there. The work of a student must be observed by someone in any case. And if a question comes up when someone is playing around that the computer program cannot answer?"

"Well why should we just talk only about school lessons? Our computer can not only teach . . ."

The fun game that the "Pravets" offers us is not so simple. I can not at all guess which number is hidden behind the unlucky little square. Khristo has better luck. He wins. The computer cheers him on, "Good boy, Khristo! You will soon play as well as I do."

But the computer, which was converted in an instant to a game, does not simply put people in a good mood. It is also designed to educate youngsters in the skills of working with microprocessors. Yes indeed, specifically youngsters! Children start getting acquainted with electronics long before school. For example, in the "Khristo Botev" region of Sofia, a specialized interscholastic center where four to five-year old youngsters come to play "Electronic Man" enjoys great popularity.

"In the long term, we want to fundamentally change the technology of school education," said the deputy minister of machine building of the Bulgarian People's Republic in a conversation with journalists, I. Tenev.

"Our task is not simply that of showing the children how to press the keys, but rather teaching them to think in a new way. Each young person must become literate in two ways while in secondary school: they must acquire the usual literacy and also 'electronic' literacy."

Of course, the problem is not one of the easy ones. There are few specialists who could teach children to operate computers. The service support for computers, the task of which is to service the computers, is not always well coordinated and does not always service the computers quickly. And there is even not enough of the computers themselves. You do not solve all of these problems in two to three years. But even now, much is being done in Bulgaria in order to meet the complex conditions for instructing young people and their working with electronics.

Admittedly, at the present time, the personal computer is more of an exception than the rule and is far from being in every school and every class does not have microprocessors with the requisite set of programs; all of these are difficulties that can be overcome. Life shows us that no matter what area man works in today, one way or another he will have to deal with electronic hardware. Without knowing how to operate computers, the "man of the future will not only prove to be untrained, but also unnecessary in the public production sector," argues the Bulgarian paper RABOTNICHESKO DELO.

It is specifically for this reason that the task of making the young people electronically literate is treated today in Bulgaria as a matter of state importance.

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NEED FOR MASS PRODUCTION OF PERSONAL COMPUTERS AND USER TRAINING NOTED

Moscow PRAVDA in Russian 13 Jan 86 p 3

[Article by A. Ryabov, doctor of technical sciences and professor, "Visiting the Computer. Higher Education"]

[Text] The following is stated in the fourth section of the draft of the Main Trends: "Take steps to significantly enhance the utilization of the scientific potential of higher schools, substantially expand the volume of scientific research and development being carried out and achieve a sharp increase in their national economic yield." It is clear that this problem is to be solved on the shoulders of only skilled, well-trained specialist personnel. For this reason, the efforts of the higher eductional institutions must be directed towards assuring high quality computer literacy of their graduates, regardless of the profession they select.

Much has been done recently in this regard. However, it must be said straight out that the state of affairs in this area is far from desirable. Can a large polytechnical institute seriously expand computer training of the students, having just a few computers in all? This situation is unfortunately not exceptional. What is the way out then?

The presence of a computer is not in and of itself a sufficient condition for the assurance of actual training of a specialist. The specifics of the teaching process require a particular configuration for a computer simultaneously serving tens of student positions. A computer is needed here which has a large memory, numerous displays and graphics peripherals as well as interfaces. Moreover, we are receiving computers today that as a rule are incorporated in systems having only a few displays.

The classes for the students are usually physically remote from the computer center room. For this reason, it is necessary to set up special amplifiers between the computer and the displays, and they are likewise not included in the complete basic system. And then it is necessary in many cases to reduce the instruction to blackboard and chalk and to go visit the computer and familiarize the student with it on field trips; the student is taught to compute in a "batch mode" when the degree of personal interaction with the computer, and consequently personal mastery of it, is extremely poor.

The resulting situation is intolerable and here is why. As is well known, a new subject has been introduced in the present academic year in the schools: "Fundamentals of information science and computer technology." A qualitatively new student complement will arrive in a few years in the nation's institutes - persons who have already mastered the rudiments of information science and computer technology. The higher educational system must take this situation into account. Here we are confronted not only with the restructuring of the teaching of the cybernetics and information and computer science, but also their application in all of the courses being studied. Essentially a restructuring of the system for training specialists is required.

Minicomputers and microcomputers are now being forwarded to academic departments in a number of higher educational institutes. This is undoubtedly stepping up their utilization in teaching. But at the same time, it is complicating the organization of repairs and technical servicing. A way out is seen in the reworking of the standard staff schedules for higher educational institution computer centers and increasing the percentage of repair personnel in them. And of course, the system of manufacturer repair and service support must be more actively developed, as is called for in the draft of the Main Trends.

The higher educational institutions are called upon to make the utmost use of the computer capacities of the sectoral ministries. There is no way around this. Teaching-scientific production associations must be created not only in the specialties in which students are graduated, but also for the computer training of the graduates. This will promote an intensification of the learning process and make the purposeful training of specialists more flexible as well as strengthen the linkage between the sectoral science and that of the higher educational institutions.

However, the main thing at the present stage is that the instructors be well prepared. It is not enough to teach programming to a physics or chemistry teacher. In order for his knowledge to be continually reinforced, he must use the knowledge gained, otherwise after a year or a year and a half he simply loses it. The issue does not involve 10 to 20 persons, but rather all teachers, without exception. It is clear that because of this, the load on the material and technical base will rise sharply. Moreover, it is necessary to develop those planning and management mechanisms for the work of teachers that will make it possible to sharply activate their interest in the application of computers to the teaching process.

An improvement in the training and an increase in the skill levels of scientific and scientific teaching personnel, as well as the work of those teachers who instruct their own colleagues, take on special significance here. It is clear that this is not the same thing as exercises with students. And the approaches to those being taught must be different, as well as the construction of the courses and the style of interaction and also the teaching methods. It is thought that the USSR Ministry of Higher Education must primarily review its attitudes towards instructors who serve on skill level

improvement faculties. Their work requires increased attention, optimum conditions for theoretical and practical preparation as well as methodological support. This is today a key point, since a poorly trained teacher cannot provide good instructions for the students, all the more since this is such a complex matter as working with computer technology.

The question of software support for the teaching process has been an acute one for some time. While the disciplines of the general technical and general engineering education that are the same or extremely close in terms of their content are present in the higher technical educational institutions, we do not have uniform standard sets of programs for teaching students these subjects. It is thought that it has long since been the time to develop them (in higher mathematics, physics, chemistry, strength of materials, electrical engineering and many others) in order that each higher eductional institution stopped doing this by relying on its own, not always adequate competence.

The future specialist in the cybernetics field of knowledge is to be taught, in my opinion, just as any other, working from fundamental courses to applied ones. A specific feature in this case is the fact that the student must master the skills of working with computers as early as the first course. This is simply essential for him in order to study all the other disciplines. But the sequence of instructional courses must be constructed so as to assure development from year to year, and by graduation, the reinforcement of the serious cybernetics base of knowledge that allows the young specialist to successfully interact with the production sector, to know how to incorporate a microprocessor in his production process, in his instrument or machine and to strengthen the level of his design and technological training. In other words, a highly effective tool must be placed in his hands both for design and for production work.

And I would like to deal with yet another problem. The draft of the Main Trends calls for the organization of the mass production of personal computers in the 12th Five-Year Plan. A new stage of computerization essentially begins with this in our nation: the introduction of computers into everyday life, into domestic routine. However, with all of the technology of personal computer use that is being continually consolidated, it is clear that operating them is within the competence of only the trained person. This means that when starting their mass production, one must also provide the appropriate training for the interested, mass user-buyer. I think that here the role of the higher school should be dominant. First of all, we must teach all students and all teachers the use of personal computers. In order to do this, the higher educational institutes must be saturated with them. The capability of setting up networks of them will incidentally allow for a considerable reduction in the severity of the problem of the material base for the computerization of the educational process.

I feel that it would be correct to incorporate an amendment in the draft of the Main Trends (Section Four), formulating it as follows: "Set up the mass production of personal computers, providing the appropriate training of their users by the personnel of the public educational system."

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INTERVIEW WITH KIEV GORKOM PARTY SECRETARY ON COMPUTERS IN SCHOOLS

Kiev PRAVDA UKRAINY in Russian 17 Jan 86 p 3

[Interview of gorkom party secretary N.N. Sergeyev by PRAVDA UKRAINY correspondent A. Sokol, "The Computer Comes to Class. School Reform: Ways of Implementation"]

[Text] Universal computer education is being widely expanded in Kiev's schools, tekhnikums and vocational and technical schools. It is being implemented on the basis of the comprehensive "Kompyuter" program, developed by the party gorkom [city party committee] and the ispolkom [Soviet executive committee] of the city Council of Peoples Deputies.

Our correspondent A. Sokol, has a conversation with the secretary of the party gorkom, N.N. Sergeyev, concerning what this project is and how it is being implemented.

[PRAVDA UKRAINY] Nikolay Nikolayevich! Previously purposeful comprehensive programs were developed in Kiev for large-scale and predominantly economic problems. Education has now become the beneficiary of this, more precisely, one of its areas . . .

[N.N. Sergeyev] This area is a key one. The computer is coming into practice in a powerful way and becoming a working tool. The upcoming generation must not only master it quite well, but also think appropriately. It is not simple to achieve this. It has been necessary to join forces and call to universal education all those who can help with it, making maximum use of the local capabilities and through this, accelerating the solution of this important and urgent problem.

The goal of the program, even in the initial period of school reform up to the year 1990, is to implement significant measures for the mastery of computer literacy by the students in secondary educational institutions and the extensive introduction of computer hardware into the teaching process. The group of problems in this effort is broad and many of them are severe. The most important are the creation of the material and technical base and the training of teaching personnel. And how, shall we say, are preschoolers to be introduced to computers? For one must begin with them . . .

[PRAVDA UKRAINY] And what preschool instruction is envisioned?

[N.N. Sergeyev] Of course the children must be taught by using the world of childhood, and primarily, toys. It is not an object of amusement. Physicians do not randomly prescribe play therapy at times for a child instead of tablets. Children's games are a serious business. For this reason, the "Kristall" production association and three institutes have been assigned the design of automated toys and computer games for preschoolers and young schoolchildren. We are also relying on the creativity and enthusiasm of inventors and efficiency experts. The competition that is in the offing between them is designed for the five-year plan: with annual and step by step totals. Some samples have already been presented. We shall place the better ones in production. Game electronics must also serve the purpose of universal computer education.

But the main component in it is naturally the schools, vocational and technical schools and tekhnikums. All of the attention is devoted to them.

[PRAVDA UKRAINY] The program has been implemented since May of last year. You can apparently already tell some of the results.

[N.N. Sergeyev] A short period of time for a large amount of work. But something has been done.

Classrooms for the "Fundamentals of Information Science and Computer Technology" have been set up in all of the schools, tekhnikums and vocational and technical schools. We are now inspecting them, improving their operation and providing visual aid supplements. It is important that practically in each such classroom there is a minimum of five microcalculators in operation, with some of them being programmable. There are about 6,000 of them in operation overall.

[PRAVDA UKRAINY] The beginning is promising. How was this done?

[N.N. Sergeyev] The base enterprises assumed a significant portion of the expenditures. The plants and organizations providing the computers additionally rendered technical and methodological assistance (they were assigned to each intermediate educational institution). This assistance is especially needed now during the period of the creation of the display classes.

The students need a display class just as a car is needed for driver education courses. We plan that by the end of the five-year plan there will be more than 100 of them. There are 17 in operation today - almost three times more than was planned for this time.

The face of the display class has still not been drawn in detail. We have not as yet determined which specific computers we shall employ. But this is now clear today: we cannot do without them. Ideally, the display class will have 15 screens - one for every two students.

Of course, much must be firmed up as the work progresses. For this purpose, an experiment is planned in three rayons: Moskovskiy, Pecherskiy and Shevchenkovskiy. The schools here will all be equipped without exception with the requisite computer hardware for the five-year plan.

[PRAVDA UKRAINY] The problem of working with "live" computers is apparently even more complex in the technical and vocational schools? Here they are simply indispensable. And personnel are also needed now.

[N.N. Sergeyev] The "Kompyuter" program takes this circumstance into account. On the average, each vocational and technical school is receiving more than 48 programmable calculators. Here they have their own computers and robots and three display classes have been opened up. On-the-job training shops and sections are being created for the vocational and technical schools at eight of the city's enterprises producing electronics. They will become a good school for future specialists dealing with the control of robot equipment, numerical program controlled machine tools, computers as well as the servicing and repair of these. It is planned that a specialized school will be constructed which will also train such working personnel.

Corrections are being made in the labor education of school students. During the course of the on-the-job training, senior class students in eight regions are already mastering the specialties of operator, programmer and repairman-metalworker. By 1988, special sections for computer technology will open in all nine interscholastic on-the-job training combines. Six combines have already acquired the computers for this purpose.

[PRAVDA UKRAINY] It goes without saying that providing the technical hardware means a great deal. But you cannot do without the teacher either. He has always been at the forefront.

[N.N. Sergeyev] This is also his role in universal computer education.

The course "Fundamentals of Information Science and Computer Technology" has been introduced in Kiev since last year in all intermediate educational institutions without exception. Therefore, the teachers are being prepared at an accelerated rate. More than 300 of them were mathematics and physics teachers who went through special retraining.

We have gone farther in the vocational and technical education system; engineering teaching and supervisory workers have been taught in computer courses. A practical work seminar was organized for school directors, with experienced specialists, scientists and academician V.S. Mikhalevich invited to it.

A special methodological teaching center is being created in the city which will provide replacement personnel. A department of school cybernetics is opening at the Institute of Cybernetics imeni V.M. Glushkov.

[PRAVDA UKRAINY] Are the specialists of higher educational institutions, scientific research institutes and enterprises being attracted to teaching? There are thousands of them in Kiev, allowed to hold more than one job.

[N.N. Sergeyev] We shall utilize those holding more than one job predominantly in work outside of class and outside of school.

[PRAVDA UKRAINY] How great are the hopes for it?

[N.N. Sergeyev] Technical creativity generates true enthusiasm and frequently provides a surprise in the form of an unexpected result. Young people are especially successful in cybernetics: the "fear" that adults have, the psychological barrier, does not bother them. Students at the radioelectronics tekhnikum, for example, have with the aid of scientists developed the "Mikrosha" - one of the best school computers in the nation. This personal computer is half as expensive as the series produced "Agat". The tekhnikum shops are ready to place the new unit on a production line and equip the schools. But there are no component parts, which are produced not only outside of Kiev, but also in other republics.

[PRAVDA UKRAINY] What forms of cybernetic creativity have been chosen?

[N.N. Sergeyev] Primarily groups and small sections. All of the industrial strength of the city has been used for their organization, especially such associations as "Zavod", "Arsenal", "Kristall" imeni S.S. Korolev, imeni Artem [sic], the "Kiev Radio Plant", the aviation "Mayak", "Elektronmash" ["Electronic Machines"], "Tochelektropribor" ["Precision Electrical Instruments"], "Kommunist", as well as the machine tool building "Bolshevik" and the "Leninskaya kuznitsa", "Krasnyy ekskavator", and "Ukrkabel" plants. Science is also participating - higher educational institutions, tens of scientific research institutes and computer centers. Where and what is to be opened each year has been determined for each of these plants. This work is being concentrated in institutions of learning, at young technicians clubs, at pioneer houses and in trade union clubs. As of today, about 2,000 students are involved in it and it is planned that more than 10,000 will be involved by the end of the five-year plan.

It is planned that seven "Kompyuter" clubs will be opened up. They are already in existence at the polytechnical institute and in the Vinogradar residential area. But they are not at all like they were conceived. The young people are now searching for and preparing a proposal for such a club.

Possibly, it will be similar to sewing and cutting classes. For the person who wants, he can be registered in the course, learn a particular computer, study its language, etc.

The first Cybernetics Day is being held during the winter break. It will become traditional and will present the possibility of one demonstrating his skill in various competitions as well as becoming more familiar with the complicated and interesting world of electronics.

[PRAVDA UKRAINY] What deficiencies are interfering with this great and important work?

[N.N. Sergeyev] The most dangerous is formalism. A restructuring is underway; the fresh wind has not completely swept this formalism away. And the notorious "red tape" will not help the matter.

It is important that a situation of general interest in the implementation of universal computer education has been successfully created. Everyone is beginning to recognize the fact that without knowing how to solve problems on computers, without this second literacy, it is impossible to successfully move ahead. For this reason, it is planned that the fundamentals of computerization will be studied even in the home economics school of the party gorkom.

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NEW JUKU PERSONAL COMPUTER FOR SCHOOLS DEVELOPED IN ESTONIA

Tallinn SOVETSKAYA ESTONIYA in Russian 12 Jan 86 p 1

[Article by A. Favorskaya, "Hello, 'Juku'!"]

[Text] Would you like to go hunting for a snake? The problem is to pin it down at the very end of the tail. This is how it goes: your "arrow" is this running mark on the screen. And quite properly the snake is also moving, continuously slipping away. And how do you do it? Well that's what the hunt is about! Patience and agility are needed here. With these keys you shoot your "arrow" and with these here you control the snake on the screen . . .

Standing around for a second (I am as yet still on just formal terms with the computer), I sit down at the computer. But then there is a successful "shot". Now you can no longer, as they say, tear me away from the keyboard.

Undoubtedly, computer games were invented so that a person, whether they are large or small, would more quickly come to be on intimate terms with the machine. And then from a game to either training or working at the computer. Because in the future, there will be nearly no work left for us, apparently, without the computer.

Yes, they say that children acquire "computer literacy" more easily and quickly. But who is really surprised by this. Isn't it really just like this with the usual literacy? And with foreign languages? But nonetheless, people can even master them at an adult age!

And in our case, for the majority of our contemporaries there is simply nothing else left other than computers. And it is already being written how children's computer clubs have begun to crop up here and there and it is necessary to prepare knowledge leaders for them. And in the pedagogical institutes, it is already necessary to teach one and all students how to work with computers. Because if the students work at electronics and computer technology with all their heart and the teacher, in the best case, does so on the side, then what kind of progress will you really have!

However, I would like to encourage those teachers who are also still "standing around": there is nothing strange here! Just a computer, just a school computer. Nothing more than the fact that your new electronic assistant has

been born, that's who he is. Judging from his references, he is clever and an almost encyclopedic scholar, in any case judging from his marks in school. And at the same time, he is an analytical thinker and diligent teacher, an indefatigable trainer and tactful corrector of your mistakes. (Having called up the game program on it, I just "caught" the snake!)

In a word, become familiar with a new school computer: the "Juku"! It was developed in the Special Design Office of the Institute of Cybernetics of the ESSR Academy of Sciences. It is elegant (it looks like a portable typewriter). It is "intelligent": it does not require any special approach, no extras that are not accessible to the ordinary school. Just a conventional black and white television with a clear screen (where one can show drawings, figures and graphs) and a simple cassette tape recorder (as the peripheral memory where the programs are stored) are connected to it for operation.

In terms of these virtues of it (and not all of them are noted here), the "Juku" is one of the first such computers in our country. These machines should "survive" for a minimum of ten years in the schools.

And oh how shaky though are the forecasts for our stormy century!

"This is why we hurried as designers," they told me at the institute and in the special design office, "We wanted for the 'Juku' to get to the classrooms as soon as possible."

"It went this way," recalls the deputy director of the institute, Julo Yaaksoo, "In May of last year, we received a request for giving some thought within a three month timeframe as to how to assist the schools and vocational and technical schools of the republic in providing computer hardware. We thought it out and promised: we would make a school computer by November."

"And?"

"It was already operating before the commission on the 14th of November."

"An all-union speed record?"

"Sure. Especially, if you consider that the busiest time came during the summer months when school was out!" agreed Reyn Khaavel, chief of the Control Systems Department of the Special Design Office. But it seems that he himself was surprised by the result although he directly supervised this work.

"How did you manage to get it done though?"

"We went at it full speed. It was interesting! And important as well: for our 'Juku', we felt that this could 'show the class', and this means, become a unique model, and capture, perhaps, the all-union market. That is, you understand, it could determine for a long time the face of school computer hardware in the nation."

Of course, they "showed the class". Why though "of course"? Well because, as early as five years ago, the Special Design Office was working on this

matter: microprocessor technology, the design of microcomputers. And they have developed, for example, even a personal computer, having turned it over to one of the plants in Tallinn.

"There were design 'nuances' that assured this suceess with the 'Juku'," Yaaksoo summed up in brief. And he added, "The main concept was the design, as it is called, of a microcomputer from the materials at hand. The machine had to be inexpensive, reliable and know how to do a lot. This is what was achieved."

The "young fellow" turned out vigorous. And how! And then there are the "parents". I was told that the director of the Special Design Office, Kalyu Leppik, expressed gratitude through a directive for this excellent work of the twenty and more enthusiasts!

"Just imagine - some 20 'Jukus' are operating simultaneously in a class - just like the one on the desk in front of me. They are tied together and to the teacher's computer - a 'Juku' especially designed for this. What a lesson can be taught! What a great possibility of working with each of the students and with all of them simultaneously. Each student has his own personal assignment and the answer from each one also appears directly on the teacher's display. And this is just a little of what the 'Juku' promises the schools!

Incidentally, world experience indicates that the computer can be used for teaching languages, histories . . . whatever you like. One can read that in the U.S. computers are even remarkably teaching preschoolers to read, write and count. And most of all, to think, formulate and respond. Logically, precisely and analytically . . . however, as far as the best utilization of the capabilities of our 'Juku' itself is concerned, the teachers themselves also have some thinking to do on this yet."

I was interested to ask at the institute, "How many such computers do you figure are already needed by the schools?"

They say about 4,000 for Estonia.

"And how much will the 'Juku' cost?"

It will be at least an order of magnitude cheaper than its "colleague", the "Agat", which is well known in the country. That is of course when it goes into production.

"And is there someone to produce these computers?"

There is. And this is a great success. The "Estron" plant and the "RET" production association are already planning to do so.

I did not catch up with the Leningrad people visiting the institute. But they say that they would also like to produce the "Juku" for themselves. That is popularity! And "straight from the cradle"!

"Will the 'Juku' probably grow up in the future into the 'Jukan'?", I ask the cyberneticians as I am leaving.

Absolutely, they reply: this will then be a personal computer for the teachers, a serious computer. They are already thinking about it in the special design office and what the "Jukan" will know how to do will be exceeded by his successor, the "Johannes".

Well, I think, this will truly be a computer for the ministry of education itself!

What then? The time is coming - a time of computers all over!

*In the photo above are only five of all of those who took part in the development of the "Juku" (from left to right): Tynu Tynspoeg, Ivar Treykelder, Reyn Paluoya, Reyn Khaavel and Tynu Arulane. [Not reproduced]

*And this is the "Juku" (photograph at the top left) [not reproduced].

Photos by F. Klyuchik.

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COMPUTER USE IN ESTONIAN SCHOOLS DESCRIBED

Tallinn KOMMUNIST ESTONII in Russian No 11, Nov 85 pp 62-64

[Article by E. Liba, director of the Nyo Secondary School: "From the Abacus to the Computer"]

[Text] It was Rene Descartes, the famous 17th century French philosopher and mathematician, who uttered these prophetic words: After having weighed everything thoroughly, I have come to the conclusion that the field of mathematics embraces only those sciences which study either order or measure, and it is quite immaterial whether that measure is being sought in terms of numbers, figures, stars, sounds, or whatever. As a matter of fact, the ever broader application of mathematics and its methods in the objective cognition of nature around us is quite typical of the development of science. Whereas at the end of the last century and the beginning of this one mathematics took over physics, chemistry, and the science of economics, now it is even invading the sphere of the humanities. The future development of any particular field of science in our time, then, depends largely on the existence of specialists with the mathematical way of thinking and the ability to apply mathematical methods. Which means that an ever larger number of young people need to be given decent mathematical training.

The general public schools which have classes offering an enriched study of mathematics according to expanded syllabi, including the fundamentals of computer science, are performing a definite role in performance of this task in our republic. The ability to use a computer is now being referred to as the second literacy. The main directions of the reform of the general public school and vocational school call for "equipping students with the knowledge and skills required to use present-day computers, for extensive use of computers in the teaching process, and for setting up special school and interschool computer rooms for this purpose." Thus the new course "Fundamentals of Informatics and Computer Science" will be taught in all general public schools. In the country's secondary schools where instruction is in Russian this course will be introduced in the 9th grade during this academic year (1 hour a week, 34 hours in all). The course will be continued in the 10th grade during the next academic year.

There is evidence of the importance of the new course in the fact that such important specialists as A. Yershov, member of the USSR Academy of Sciences,

and V. Monakhov, corresponding member of the USSR Academy of Pedagogic Sciences, are concerned with the problems of teaching it. Both of these scientists are taking part in preparing the textbook for the course.

In schools with instruction in Estonian the new subject will be taken as an elective in one of the schools in each city and rayon. All teachers of this subject have taken the necessary courses. The experience in the current academic year should help in organizing the teaching of the fundamentals of computer science in the future. The most important problem which needs to be solved is building the computer facility in the schools. Opportunities are now being sought out for manufacturing the necessary computers in our own republic. There has long been a need to teach the fundamentals of informatics and computer science in the schools. Many people need to be able to work with computers right now; it is inevitable that tomorrow everyone will need to do so. This January the Politburo of the CPSU Central Committee approved a nationwide program for development, growth of production, and efficient use of computers and automated systems up to the year 2000. Performance of this program instills confidence that the general public schools will have an improved supply of computers.

The Nyo Secondary School has a student body of 700 divided into 25 grade-sections and about 100 teachers, counselors, engineers, and technicians. Our school enrolls children who show an interest in the precise sciences from all over the republic. We have had classes with enriched study of mathematics and physics since 1964. The purpose of this article is to share experience in organizing the work of these classes and the prospects for the future.

The development of computers in our country began in the fifties, as is well known. The production of computers has gradually grown, and the training of personnel to operate them was put on the agenda and was then organized in educational institutions which by that time already had their own computer centers with the necessary equipment. In our republic students began to be initiated into the secrets of the computer in 1961. The Tartu First Secondary School was the first to start a class with enriched study of mathematics and physics in that year; the syllabus of the course also included the fundamentals of programming and work with the computer. The practical training was done in the computer center of Tartu State University, which at that time had the first-generation "Ural 1" computer.

Special classes in mathematics and physics were created in our school 3 years later than in the Tartu First Secondary School. When the university received a new computer, it turned the old one over to us. Our own personnel and students in the upper classes adapted and furnished two rooms for the computer, and soon the country's first computer center in a general public school went into operation. The principal personnel came to us from Tartu State University together with the computer. Since the personnel of the VTs had already been teaching the fundamentals of computer science in the Tartu First Secondary School, the teaching effort went smoothly in our case from the very beginning.

Programs for the "Ural 1" could be written only in machine language, which takes time to learn. So that the students could broaden their knowledge in the field of programming, beginning in 1972 they were taught the programming language MALGOL in the 11th grade, and programs written by the students have been used in the Tyravere Observatory.

Computer science was developing rapidly. It was soon necessary to acquire a new computer. Our request was met, and we received a "Nairi 3-1" computer, and we began to work with it in the fall of 1977. Since that time the programming language FORTRAN has been taught in the 11th grade. At that same time, our computer center became the resource facility for other schools in which the fundamentals of informatics and computer science were being taught. During vacations--in January and March--students came to us from the Vyru First, Vilyandi First, and Valga First Secondary Schools for practice, and they reinforced the theoretical knowledge they had received in their own school under the supervision of the computer center's personnel.

Beginning in 1979 girls in general practical arts courses learned the job of computer operator. Since operators must be good typists, a typing class was also started.

As the number of class hours and students studying in the computer center increased, the question arose of building a separate building. The year before last construction of a two-story building with 350 m^2 of total floor space was completed; it now houses the school computer center. The staff of the center itself under the supervision of its chief engineer Aarne Kivimyae and also the students did good work on that construction site. Yet another computer--a YeS-1020--was installed in the new quarters; it is used as the basis for teaching the programming language Pascal, and jobs are done for the Ministry of Education.

In order to improve the teaching process the center developed and implemented the "Yuku" programming system, which went into service in 1981. It has been repeatedly supplemented since that time. It makes it possible to store in the computer 600 programs from 300 users. MALGOL, ROPS, and KYPS serve as the system's languages. The latter two were developed right in our own computer center and are intended for the teaching of programming to beginners.

This year Professor Kh. Tammet of the Tartu Pedagogic Institute developed a system for writing synthesized problems. It can be used to generate problems in physics, mathematics, and chemistry in such a way that every student receives problems with different data. The teacher has an answer sheet that makes it easier to check the solutions. We develop problems like this for schools throughout the republic which have requested them. Our experience indicates that the synthesized problems can be used effectively for homework and quizzes.

The computer center now has three lines of activity: 1) teaching the fundamentals of programming, 2) preparing synthesized problems (writing new ones and generating variations of those that already exist) with the active participation of the students, and 3) developing a formal method as a guide for

teachers. The fundamentals of programming are being taught as part of polytechnic studies and in the practical courses given in the spring.

The study of a programming language usually begins by printing out a picture "drawn" by the computer, with mastering the call command. The students like to make an image of their name, house, some animal, and so on. Gradually they become bold in interacting with the computer, and this is very important. At first they refuse to believe that the computer is unable to think. Especially when they see how unsparing it is in catching errors in syntax. But this motivates the students to check themselves more closely, to be more accurate, and this in turn helps to develop their analytical thinking and the ability to think ahead.

In every class there are students who quickly surpass their fellow students in their degree of success. Their further work and development culminate in acquiring a rather extensive and sound knowledge of programming. By the time they graduate from secondary school, they manage on their own to master quite a bit of the specialized literature, mostly in Russian and English.

The last 3 years the best students in our school have participated successfully in the work of the all-union summer school in Novosibirsk. Ivo Khaamer and Tynu Saarsen, who graduated last year, were awarded certificates in Novosibirsk for the paper and programs they presented at the conference. That success aroused enthusiasm. This August our teachers Kharri Keerutaya and Uuno Puus went to Novosibirsk (the latter was awarded a commendatory certificate for effective participation in the work of a summer school), as did the graduates Kheyki Kyubbar, Toomas Saarsen, and Martti Raydal, along with Tynu Saarsen, who is now already studying cybernetics at the Tartu Polytechnic Institute. They were all awarded first-degree certificates for the projects they did in summer school.

We are convinced of the great value of studying programming from the standpoint of general education and character-building. We use the computer for purposes directly related to building character: For several years, for example, a program has been in use which returns the students' average grades and keeps a record of class attendance. The grade supervisors, parents, and the Komsomol and student committees can at any time get an idea of these figures on academic performance. The computer also produces a table showing student performance in a dynamic series which we post on the bulletin board. It has the strongest impact in building character.

The so-called personal computer is opening up altogether new prospects for the use of computers in the school. Very diverse graphic information can be presented on the screen of the visual display of a present-day personal computer. Assuming it has the appropriate software, the computer can also be used as a visual teaching aid with very broad capabilities. The development of such programs has already begun in our school with the help of students in the upper grades. I demonstrated programs for the "Apple" at last year's conference of mathematics teachers and on the television program "Teleshkola."

The preparation of software is altogether with the abilities of the most successful and interested students, but personal computers seem to be traveling a thorny road in getting to the school. In a trial effort we are using personal computers belonging to the department of programming of Tartu State University and the Institute of Astrophysics and Physics of the Atmosphere of the Estonian Academy of Sciences. In future the writing of software will require not simply personal computers, but configurations built around them. Then it would be possible to apply the syllabi in practice and to answer the question of how computer-based teaching influences formation of concepts and skills and how it promotes faster and sounder assimilation of the subject matter.

The teaching of the fundamentals of informatics and computer science in our school began to attract particular attention after publication of the basic directions of the school reform. Last April our party members, headed by Maye Ambre, secretary of the party organization, familiarized television viewers with the school's effort at education and upbringing on the television program "A Day in a Primary Party Organization." This spring we have had visitors on several occasions (party and Soviet officials and pedagogues) from other union republics interested in the work of our computer center. The meetings followed a question and answer format. We had an opportunity to compare our own experience with that of the visitors. In any case we had no reason to make things seem better than they were. This February the Institute of Problems of Informatics of the USSR Academy of Sciences and Tartu State University conducted an all-union conference on the problems of teaching the fundamentals of informatics and computer science as well as computerization of the school. Our experience received a favorable appraisal in the conference.

Albums showing the work of the special classes and the computer center of the Nyo Secondary School as well as our teaching of the fundamentals of informatics and computer science have been exhibited in the "Public Education" Pavilion at the USSR Exhibition of Achievements of the National Economy. They show the history of the school computer center, the method of teaching the fundamentals of informatics and computer science, and samples of projects done by the students.

Summer courses on the fundamentals of informatics and computer science are held in our school in June in which teachers from TGU and our own teachers present lectures and conduct workshops with students of resource schools and school inspectors.

It can be said in conclusion that in our school we are doing everything so that the students acquire diverse and profound knowledge in the exact disciplines. By all appearances we are on the right road in using computers in teaching. The basic directions of the school reform and the nationwide program for developing, manufacturing, and effective use of computers and automated systems can serve as evidence of that.

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COMPUTER TRAINING AT BREST STRUCTURAL ENGINEERING INSTITUTE

Minsk NARODNOYE KHOZYAYSTVO BELORUSSII in Russian No 10, Oct 85 p 43

[Article by E. Kobyak, "Students Become Friends with Computers"]

[Text] The Brest Structural Engineering Institute is training specialists in industrial and civil construction, agricultural construction, drainage and irrigation construction, machine building technology, municipal construction, water supply and sewage system design, as well as the efficient utilization of water resources. More than 4,500 students are studying in six departments. They receive thorough training in the fundamental sciences and a solid foundation in social disciplines.

The teaching of programming and the utilization of computers to young specialists occupies a special place. A computer center equipped with modern computers is in operation at the institute. Starting with the first course, all students gain access to independent work with the computers in an interactive mode using displays. Many of them do their own course and diploma work on the computers.

Such training is necessary, since many calculations in the planning and construction organizations are performed on computers. In this case, computer-aided design (CAD) systems are becoming increasingly widespread; in addition to ordinary calculations, these provide for computer output of design and estimate documentation, including the working drawings for the planned facilities and structures.

Many students are doing scientific research work under the supervision of skilled teachers, doctors and candidates of science. Institute-level scientific and technical conferences as well as subject area olympiad competitions in mathematics, physics, chemistry and computer programming are held annually. The better students participate in republic and all-union conferences and olympiads.

The 800 graduates of the institute annually join the ranks of specialists in the national economy.

In the photographs [not reproduced]: in one of the auditoriums of the institute; the chief of the department of computer technology and applied

mathematics at the institute, Vladimir Gavrilovich Afonin assists a student, Nikolay Novik, in work with the SM-4 computer system.

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COMPUTERS TO BE USED IN CLASSROOM IN 1986-1987

[Editorial report] Ashkhabad MUGALLYMLAR GAZETI in Turkmen 6 November 1985 carries on page 2 a 400 word article by S. Khanov, teacher at the Turkmen State University, on a seminar held in Ashkhabad Oblast designed to train Turkmen teachers in the use of computers. "Starting in the 1986-1987 school year 9th grade secondary school students in Turkmen lagnuage schools will begin studying a course in information and computer technology. In October a two-week seminar was held in Ashkhabad Oblast for teachers who will teach this subject." The 150 mathematics and physics teachers "heard with great interest lectures on the scientific-methodological principles of the new subject, the objectives in teaching students computer literacy, its structure and content, algorithms and principles of writing them, explanations of algorithms for defining questions, programming the computer, the operating principles and construction of computers, and on equipping offices for computer technology." The demonstration computer was an ES-1020.

LACK OF AZERI TEXTS IMPEDES COMPUTER EDUCATION

[Editorial report] Baku KOMMUNIST in Azeri on 7 January 1986 carries on page 3 a 700-word article by M. Samad on the progress being made in introducing the course "Fundamentals of Information Science and Computer Technology" into the secondary schools. "More than 200 departments have been established in republic schools, and these have been equipped with more than 4,500 MKSh-2 calculators. Soon BZ-21, BZ-34, MK-54 and MK-56 programmed microcalculators will be used widely in the schools. In 1986, 3,000 such calculators will be sent to general education schools; this will make it possible to create 150 new departments." The problems are that "computer work is unsatisfactory in a number of schools"; "the preparation of teachers engaged in modern computer technolocy is at a low level"; and "there are no relevant textbooks or literature on computer technology in Azeri."

COMPUTERIZATION SPREADS IN GEORGIA

[Editorial report] Tbilisi KOMUNISTI in Georgian on 1 January 1986 carries on page 3 a 900-word article by Mikheil Khoshtaria, head of the Scientific-Technical Propaganda Department of the Scientific-Research Institute for Scientific-Technical Information and Scientific-Economic Research (Issledovaniya) (under the State Committee for Science and Technology), concerning the rapid spread of computers in the republic and prospects of future growth, especially as regards general-purpose personal computers. Microcomputers are in use in more and more sectors. School students, pupils, and even preschoolers are being given training programs to gain familiarity with the capabilities of these "versatile, faithful, uncomplaining, inexpensive" servants. Local computer networks are coming into being. Strides are being made toward "paper-free" office and business management. Brief mention is made of a TAP-34 microcomputer in Tbilisi that is hooked up to the Scientific-Technical Information Center in Moscow to provide direct "thematic searches" in that installation's data base and request copies of primary sources. Khoshtaria's institute is one of the first to computerize its departments, and steps are being taken to create various automation systems.

Three accompanying photos show instruction in PC operation; the TAP-34 terminal that is hooked up to Moscow; and a close-up of a screen displaying a sample of Georgian text, which is a relatively recent development.

LOCAL COMPUTER NETWORKS DISCUSSED

Moscow EKONOMICHESKAYA GAZETA in Russian No. 9, Feb 85 p 19

[Article by Professor V. A. Myasnikov, chief of Main Administration of Computer Technology and Control Systems, State Committee for Science and Technology]

[Text] Investigations show that 60-80 percent of all information generated in one or another organization is used directly within it circulating among subdivisions and colleagues. (Footnote) (See EKONOMICHESKAYA GAZETA, Nos. 37, 40, 47, 49, 1985; Nos. 2, 4, 1986) Only the remaining part is output in generalized form, for example, it is sent to ministries and departments.

This means that computer hardware, concentrated by subdivisions and workstations, should function in a unified process. Workers must have the capability of communicating with each other through user stations and also with a unified or distributed data bank. At the same time, it is important to provide high efficiency in the use of computer technology.

The appearance of microelectronic devices of medium and large-scale integration, personal computers and equipment with built-in microprocessors contributed to solution of this problem to a considerable degree. As a result, along with regional computer networks, designed on the basis of mainframe computers and distributed over a large territory, so-called local computer networks (LVS) have appeared and are becoming more widespread.

Local computer networks are a network, functioning according to adopted protocols (rules), open for connection of additional user stations and computer hardware. The processing, transmission and storage devices in the local computer network are arranged at a distance of up to several kilometers from each other and sometimes tens of kilometers, that is, within one or a group of buildings. The hardware of the local computer network interacts through a unified communication channel (monochannel), which supports high data transmission speed--up to 10-50 megabits per second.

Computers of both the same types (homogeneous networks) or of different types (heterogeneous networks) and of different degree of performance can be connected into the network.

Homogeneous networks are simpler and less expensive. Relatively simple equipment and software that do not require a large number of types of integration

units are used for development of them. The use of "internal" communication lines in the local computer network without resorting to a general-purpose network permits a significant cost reduction.

Local computer networks are now a universal base of the modern information processing industry and are characterized by a wide variety of methods of compiling any types of information: data, speech, television images and control signals. Therefore, local computer networks can be used in essentially all spheres of production, planning, accounting, administrative management, scientific research, design and the academic process.

Small enterprises have the capability of joining personal, micro- and minicomputers into a unified computer network due to local computer networks, while large enterprises can relieve the computer center of some functions in processing information of "in-house significance."

The use of local computer networks produces a large saving. For example, creation of an indirect route for design of microprocessors on the basis of local computer networks made it possible to reduce the development times by 35 percent and at the same time to reduce cost by 48 percent. The developer specialists carry out joint design at their workstations through the use of user stations. Bottlenecks of a product are determined during design, which cuts in one-half the volume of work in modification of the product before the industrial model. The development of documentation is automated at the same time.

Introduction of local computer networks is accessible to the mass user. Thus, one can create distributed computer capacities and databases, information retrieval and reference services in organizations and institutions, one can combine into a unified system automated workstations, printers and copiers, graph plotters, cash registers and so on. Local computer networks make it possible to improve the reliability of information processing by duplication of resources in the network, of editing letters, lists and accounts, of exchanging documents without printing them on a paper carrier, of maintaining bookkeeping and warehouse accounts, of controlling robots, machines and machine tools, of transmitting information within a given time, of using a priority system, of dispatching circular announcement to all, some or a single subdivision and of holding teleconferences.

As local computer networks are developed, its configuration can be altered, it can be combined with other local computer networks (for example, at a large enterprise or at an association) and the local computer network can be connected to a regional computer network, which permits integrated ASU [automated control system]. The local computer newwork can become a paperless office at a specific phase of development, in which information is written to magnetic tapes, disks and microfilm with the capability of production and reproduction of hard copy and also, on the other hand, of receiving machine carriers from hard copy.

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